INFANT SIMULATOR

FIELD OF THE INVENTION

This invention broadly relates to the field of simulated child care. More specifically, the invention relates to infant simulators used in educational programs for educating prospective parents about the realities of parenthood, assisting in the education and training of personnel entering the child-care profession, and assisting in the continuing education of persons working in the child-care profession.

BACKGROUND

Teen-age pregnancy is an ever increasing problem. Teen-age parents, surveyed as to why they elected to have a baby, gave such reasons as "babies are so cute," "I wanted attention," and "I needed someone to love and love me back." Such romantic feelings toward having a baby almost never include an understanding of the responsibilities imposed by a baby, including loss of sleep, loss of freedom, the need for constant attention, etc. Attempts to educate teen-agers about the trials and tribulations of caring for an infant and raising a child, using the traditional educational methods of lecture and readings, are rarely successful.

Some resourceful educators, realizing that traditional educational methods are inadequate, have attempted to demonstrate the care requirements of an infant by requiring students to carry a sack of flour, an egg or a plant for several days. While somewhat exemplary of the care requirements of an infant, such programs do not fairly represent the care requirements of an actual infant and have proven to be of limited success.

United States Patents Nos. 3,190,038 issued to Kardon, 3,490,170 issued to Wolf, 3,514,899 issued to Bonanno et al., 4,115,948 issued to Burks and 5,094,644 issued to Kelley describe dolls that will wet a diaper after being fed from a bottle. The dolls described in Kardon and Wolf each include electrical circuitry capable of initiating crying when a diaper on the doll is sufficiently wetted after being fed from a bottle, and terminating such crying upon removal of the wetted diaper. Similarly, the doll described in Bonanno et al. further includes electrical circuitry capable of initiating crying when the doll is diapered and a bottle is removed from the mouth of the doll, and terminating such crying by removing the diaper from the doll. Such dolls are not useful for educating students about the trials and tribulations of caring for an infant as the feeding and wetting cycle, with or without crying, is under control of the user. The student, unless under constant supervision by an educator, can feed and change the doll on a schedule selected by the student. In addition, the dolls do not acurately simulate the care requirements of an actual infant in that the student is not instructed by the doll to replace the wetted diaper with a dry diaper to terminate crying.

United States Patents No. 4,249,338 issued to Wexler discloses a doll which emits a crying sound when a manually operated switch is actuated. The user must then determine which of several switches, labeled with such actions as feeding, diaper changing or back patting, will turn off the crying sound. While interesting as a plaything, this doll suffers from the same drawback as the "feed and wet" dolls in that activation of crying is under control of the user. The student, unless under constant supervision by an educator, can activate crying on a schedule selected by the student.

United States Patents No. 4,451,911 issued to Klose et al. discloses a doll which can operate in two different modes. In a first mode, the doll emits different sounds based upon which of several switches, located at various positions on the body of the doll, is actuated (e.g., actuation of the mouth switch produced "yum-yum," while actuation of the back switch produces "aahh"). In a second mode the doll emits a sound and the user must then determine which of the switches will turn off the crying sound and

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produce a satisfaction signal, such as "mommy." The user can deactivate the doll by pressing a specified switch on the doll or simply failing to activate the proper switch within a given time period. Again, while interesting as a plaything, this doll suffers from the same drawback as the "feed and wet" dolls in that activation and deactivation of the doll is under control of the user. The student, unless under constant supervision by an educator, can activate and deactivate the doll on a schedule selected by the student.

A particularly useful infant simulator system for use in educating students about the care requirements of an infant is described in United States Patent No. 5,443,388 issued to Jurmain et al. and assigned to the assignee of this application. The patent discloses an infant simulator capable of crying at intervals, with the crying continuing until a quieting key is inserted into the infant simulator and continuously held in position against a biasing means for a defined time period. The crying schedule may be changed to simulate either a healthy or a sick infant. A tremblor may be included to cause the infant to shake at intervals for purposes of simulating a drug-dependent infant. The infant simulator can also include indicators showing rough handling, improper positioning and the detection of a loud sound. The quieting key may include a means for securing the key to an assigned individual.

While the infant simulator described in United States Patent No. 5,443,388 and sold under the trademark BABY THINK IT OVER® has proven extremely useful as an educational tool, a continuing need exists for an improved infant simulator capable of realistically demonstrating the variety of needs and care requirements of an infant, as well as the positive aspects of caring for and loving an infant.

SUMMARY OF THE INVENTION

The infant simulator includes a variety of features designed to emulate the care requirements of an infant. The infant simulator can be designed and programmed

with any combination of the described features, including the ability the selectively activate and deactivate individual features for each assignment period. The infant simulator is equipped to record the quality of care and responsiveness of a person caring for the infant simulator and/or signal the person caring for the infant simulator when care is required.

The features can be conveniently grouped into the categories of (i) environmental condition sensors, (ii) episodic events, and (iii) ancillary features.

ENVIRONMENTAL CONDITIONS

Temperature Sensor

Infants should not be exposed to temperature extremes. The infant simulator can be equipped with a temperature sensor capable of sensing the environmental temperatures to which the infant simulator is exposed.

In a first embodiment, the infant simulator is further equipped with a system for recording the sensed temperature. In a second embodiment, the infant simulator is further equipped with a system for generating a perceptible thermal exposure signal when the sensed temperature falls above or below a defined acceptable temperature range. A preferred embodiment combines both the recording and signaling systems so that the person caring for the infant simulator is advised when the environmental temperature has reached an unacceptable level and the recorded information can be reviewed by a teacher or administrator upon completion of the assignment.

Compression Sensor

Infants must be handled with care at all times and should never be squeezed. One of the more prevalent abuses results when a frustrated care provider squeezes the infant, usually the infants arm, leg or head. The infant simulator can be equipped with a compression sensor capable of sensing compression of the infant simulator.

In a first embodiment, the infant simulator is further equipped with a system for recording the sensed compression. In a second embodiment, the infant simulator is further equipped with a system for generating a perceptible distress signal when compression is sensed. A preferred embodiment combines both the recording and signaling systems so that the person caring for the infant simulator is immediately notified that they have injured the infant simulator and the recorded information can be reviewed by a teacher or administrator upon completion of the assignment.

EPISODIC EVENTS

Diaper Change

Infants require periodic diaper changes. A realistic simulation of a diaper change should include the actual changing of a diaper. By requiring the "soiled" diaper to be removed and a new diaper placed upon the infant simulator, the person caring for the infant simulator learns that you must carry an extra diaper at all times, and gains a more complete understanding of the requirements of an actual diaper change (*e.g.*, a person carrying the infant simulator into a restaurant would, assuming some level of modesty and etiquette, take the infant simulator to the rest room to change the diaper).

The infant simulator can be equipped with (i) a system for generating a perceptible soiled-diaper signal, (ii) a system in communication with the soiled-diaper signal generating system for arresting the soiled-diaper signal in response to receipt of a diaper-changed signal, and (iii) a diaper configured and arranged to be fitted over the lower torso of the infant simulator as a diaper, with the diaper having a means effective for transmitting the diaper-changed signal to the soiled-diaper signal arresting system when the diaper is fitted on the infant simulator.

The infant simulator can further be equipped with a system for measuring and recording the duration of each diaper-change episode (*i.e.*, the time period between initiation of the perceptible soiled-diaper signal and completion of a diaper change effective for transmitting the diaper-changed signal.)

Rocking

Infants often like to be gently rocked. Parents and other care providers will often rock an infant when the infant is fidgety or fussy, or when the person simply wants to comfort the infant. A realistic simulation of rocking should require actual rocking of the infant simulator.

The infant simulator can be equipped with (i) a system for generating a perceptible rocking-request signal, and (ii) a system in communication with the rocking-request signal generating system for detecting rocking of the infant simulator and arresting the rocking-request signal when rocking is detected.

The infant simulator can further be equipped with a system for measuring and recording the duration of each rocking-request episode (*i.e.*, the time period between initiation of the perceptible rocking-request signal and the commencement of rocking.)

Feeding with Burp

Infants must be regularly fed. A realistic simulation of a feeding should require both feeding and burping of the infant simulator. In order to accurately emulate a feeding, the infant simulator can be equipped with both a feeding-request module and a burping-request module, with the burping-request module requiring actual patting of the infant simulator.

The feeding module can include (i) a system for generating a perceptible feeding-request signal, (ii) a system in communication with the feeding-request signal generating system for arresting the feeding-request signal in response to receipt of a feeding signal, (iii) a device for transmitting the feeding signal to the feeding-request signal arresting system when placed in communicative proximity to the infant simulator and thereby arresting the feeding-request signal.

The burping-request module can include (i) a system for generating a perceptible burping-request signal, (ii) a system for initiating generation of the burping-request signal in communication with both the feeding-request module and the burping-request signal generating system for initiating generation of the burping-request signal after the feeding signal is received by the feeding-request module, and (iii) a system in communication with the burping-request signal generating system for detecting patting of the doll and arresting the burping-request signal when patting is detected.

The infant simulator can further be equipped with a means for individually or separately measuring and recording the duration of each feeding-request episode and each burping-request episode (*i.e.*, the time period between initiation of the perceptible feeding-request signal and the commencement of feeding for a feeding-request episode, and the time period between initiation of the perceptible burping-request signal and the commencement of patting for a burping-request episode.)

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Fussy and Demand Event

Infants will occasionally fuss for one reason or another and, despite every effort by the parent or other care-provider, cannot be comforted. In such situations, the infant tends to continue fussing until the unknown cause of the fussing dissipates of its own accord. In order to accurately emulate the frustration encountered by parents and other care-providers in such situations, the infant simulator can be equipped with a demand module (*e.g.*, a diaper-change module, a rocking module, a feeding module, etc.) and a fussing module, wherein only the demand module is capable of being satisfied.

The demand module can include (i) a system for generating a perceptible demand signal, (ii) a system in communication with the demand signal generating system for arresting the demand signal in response to receipt of a satisfaction signal, and (iii) a device for transmitting the satisfaction signal to the demand signal arresting system when placed in communicative proximity to the infant simulator and thereby arresting the demand signal.

The fussing module can include (i) a system for generating a perceptible fussing signal, (ii) a fussing interval timer in communication with the fussing signal generating system for initiating generation of the fussing signal at intervals; and (iii) a fussing duration timer in communication with the fussing signal generating system for terminating generation of the fussing signal at the end of a fussing period.

Since the fussing module does not include a system capable of arresting the fussing signal, the fussing signal will necessarily continue until the end of the fussing period regardless of the actions of the parent or other care-provider.

ANCILLARY FEATURES

The features described below are labeled as ancillary features because they function to enhance performance of an infant simulator exhibiting at least one type of a demand event. For practical purposes, the disclosed ancillary features are operable in combination with any of the demand modules disclosed herein (*i.e.*, diaper-change, rocking, feeding with burp, and fussing with demand event) as well as any other demand module requiring the parent or other care-provider to provide the infant simulator with a satisfaction signal.

As utilized herein, including the claims the phrase ***"demand module"*** references a module which includes at least (i) a means for generating a perceptible demand signal, and (ii) a means in communication with the demand signal generating means for arresting the demand signal in response to receipt of a satisfaction signal. As a general matter, a "demand module" signals a care-provider that some type of interaction is required between the care-provider and the infant, and arrests the signal when the required interaction is provided.

Contented Signal Feature

The responsibility of caring for an infant can engender the contrasting emotions of fulfillment and frustration. A realistic simulation of caring for an infant should include events emulating both the positive and negative aspects of caring for an infant.

The infant simulator can be equipped with a contented condition module which, in combination with a demand module, for providing positive feedback to the person caring for the infant simulator when proper care is provided. The contented module can include (i) a system for generating a perceptible contented signal, and (ii) a system in communication with the demand module and the perceptible contented signal

generating system for initiating generation of the contented signal after a satisfaction signal has been received by the demand module.

Escalating Demand Signal Feature

Infants can provide a variety of perceptible signals to parents and other care-provides requesting that a need be satisfied. While the most common signal is crying, other signals include fidgeting, fussing, gasping, repeated side-to-side shaking of the head, rubbing of the eyes and face, and whining. In addition, infants will usually escalate the signal over time when the need remains unsatisfied. Hence, a realistic simulation of caring for an infant should provide for an escalation in the strength, intensity and/or severity of a demand signal as the demand remains unsatisfied over time.

An infant simulator having a demand module can be further equipped with a system in communication with the demand module for escalating the perceptible demand signal generated by the demand signal generating system as the duration of the demand episode increases.

Identification System Feature

In order for a student to fully appreciate the responsibility of caring for an infant, and for a teacher to provide meaningful feedback to the student, it is important that the student to whom the infant simulator is assigned tend to the demands of the infant simulator. In other words, it is important that the infant simulator be equipped with some type of system which requires the assigned student to tend to the needs of the infant simulator, or at least be present when the duties are discharged.

For purposes of ensuring that the assigned care-provider is at least present when the demands of the infant simulator are being satisfied as required by the demand module, the infant simulator can be equipped with an identification feature including at

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least, (i) a system for receiving an identification signal personal to the assigned care-provider, and (ii) a system in communication with the identification-signal receiving system and the demand module effective for preventing arresting of the demand signal until the identification signal is received by the identification-signal receiving system.

Multiple Behavior Modes Feature

Infants have different care requirements. Some infants will sleep for several hours at night, while others will wake almost every hour and require some type of attention. In order to emulate the different care requirements of different infants, the infant simulator can be equipped to permit a teacher or administrator to select between several programs which require different levels of care. These different levels of care can be produced by altering the time interval between events (*i.e.*, increase or decrease the number of events occurring within an assignment period) and/or altering the duration of each event (*i.e.*, increase or decrease the length of each period). The different levels of care can be set to represent the care requirements of an easy, an average and a difficult infant, thereby allowing the teacher or administrator to tailor the simulation to each specific student.

Brief Description of the Drawings

Figure 1 is a perspective view of one embodiment of the infant simulator including one embodiment of an identification key and tamper indicating bracelet.

Figures 2a-2j are a flowchart of one embodiment of the infant simulator.

Figure 3 is a cross-sectional side view of the infant simulator shown in Figure 1, showing one embodiment of the internal electrical components of the infant simulator.

Figures 4a is a perspective view of one embodiment of a first diaper for use in combination with the infant simulator for transmitting a diaper-change satisfaction signal.

Figures 4b is a perspective view of a portion of one embodiment of a second diaper for use in combination with the infant simulator for transmitting a diaper-change satisfaction signal.

Figures 5 is a perspective view of one embodiment of a bottle for use in combination with the infant simulator for transmitting a feeding-request satisfaction signal.

DETAILED DESCRIPTION OF THE INVENTION INCLUDING A BEST MODE

Definitions

As utilized herein, including the claims, the term "***activated***," when used to describe the condition of an infant simulator, means that (i) at least one of the environmental sensors and associated means for recording the sensed environmental variable are sensing and recording (*e.g.*, environmental temperature or compression), and/or (ii) at least one of the episodic demand events is capable of occurring at any time or the time interval to such occurrence is being timed (*e.g.*, diaper-change, feeding, or fussy event).

As utilized herein, including the claims, the term "***arrested***," when used to describe the condition of a perceptible signal generating means, means that the perceptible signal is no longer expressed and includes both termination of the signal (*i.e.*, the perceptible signal will not be generated until reinitiated by the occurrence of a defined

condition or event) and inhibition of the signal (*i.e.*, the perceptible signal will be expressed upon the removal or cessation of a specific condition or event).

As utilized herein, including the claims, the phrase "***assignment period***," means the period of time during which the infant simulator is activated and the assigned person or team is given custody of the infant simulator (*e.g.*, overnight, 48 hours, one week, etc.).

As utilized herein, including the claims, the phrase "***burping-request episode***," refers to the event of burping the infant simulator in reaction to a demand signal from the doll indicating a desire to be burped. Each burping-request episode, from the perspective of a care provider, begins when a perceptible burping-request signal is initiated and ends when patting of the infant simulator is commenced. It is noted for purposes of clarity that this definition is not intended to mandate the specific signal received by the burping-request episode duration measuring means for initiating the timing of a burping-request episode (*e.g.*, timing of a burping-request episode can be initiated by a signal emanating from the burping-request interval timer or a signal generated by the perceptible burping-request signal generating means), nor specify the particular sequence by which an electrical signal must travel through the burping-request module (*e.g.*, the burping-request module may be configured and arranged so that the burping-request episode duration measuring means receives a signal to start timing a burping-request episode before, after or simultaneously with the receipt of a corresponding signal by the perceptible burping-request signal generating means).

As utilized herein, including the claims, the phrase "***elevated compression***," means compression of a magnitude such that discomfort or injury would normally be inflicted upon an actual infant. Compression having a magnitude insufficient to be classified as an "elevated compression" include specifically, but not exclusively, a compression resulting from such routine activities as bathing, patting to elicit a burp,

ordinary handling, hugging, lying on a carpeted floor, rubbing of the stomach, light tickling, etc.

As utilized herein, including the claims, the phrase "***compression episode,***" means the time period beginning when compression is sensed and ending when compression is no longer sensed.

As utilized herein, including the claims, the term "***continuous***," when used in connection with the demand event of *feeding the doll*, means that the feeding signal transmitting means (*e.g.*, a bottle) is held in communicative position relative to the doll by a care provider so as to transmit the feeding signal to the feeding-request system (*e.g.*, the bottle is inserted into the mouth of the doll) without release of the feeding signal transmitting means by the care provider for any appreciable time period (*i.e.*, from a fraction of a second up to as long as about five seconds).

As utilized herein, including the claims, the term "***continuous***," when used in connection with the demand event of *rocking the doll*, means that the doll is subjected to appropriate levels of accelerative motion without stop or separated only by stationary periods of modest duration (*i.e.*, from a fraction of a second up to as long as about five seconds).

As utilized herein, including the claims, the term "***continuous***," when used in connection with the *recording of temperature values*, means that the temperature is recorded on a predetermine schedule (*e.g.*, every nanosecond, every second, every ten seconds, every two minutes, etc.) without interruption.

As utilized herein, including the claims, the phrase "***demand episode***," refers to an event requiring a specified interaction between the doll and a care-provider in response to a signal from the doll that such an interaction is desired. Each demand episode, from the perspective of a care provider, begins when a perceptible demand signal

is initiated by the doll and ends when an appropriate satisfaction signal or action is transmitted to the doll in response to the demand signal. Exemplary, demand episodes include specifically, but not exclusively, diaper-change episodes, feeding-request episodes, burping-request episodes and rocking-request episodes.

As utilized herein, including the claims the phrase ***"demand module"*** references a module which includes at least (i) a means for generating a perceptible demand signal, and (ii) a means in communication with the demand signal generating means for arresting the demand signal in response to receipt of a satisfaction signal. As a general matter, a "demand module" signals a care-provider that some type of interaction is required between the care-provider and the infant, and arrests the signal when the required interaction is provided.

As utilized herein, including the claims, the phrase "***demand period***," means the period of time during which the demand signal will be generated and expressed by the doll unless a satisfaction signal or action is being received by the doll. Exemplary, demand periods include specifically, but not exclusively, diaper-change periods, feeding-periods, burping periods and rocking periods.

As utilized herein, including the claims, the phrase "***diaper-change episode***," refers to the event of changing the doll's diaper in response to a signal from the doll that the diaper is soiled. Each diaper-change episode, from the perspective of a care provider, begins when a perceptible soiled-diaper signal is initiated and ends when a changed-diaper signal is transmitted. It is noted for purposes of clarity that this definition is not intended to mandate the specific signal received by the diaper-change module for initiating or terminating the timing of a diaper-change episode (*e.g.*, timing of a diaper-change episode can be initiated by a signal emanating from the diaper-change interval timer or a signal generated by the perceptible soiled-diaper signal generating means), nor specify the particular sequence by which an electrical signal must travel through the diaper-change module (*e.g.*, the diaper-change module may be configured and arranged

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so that the diaper-change duration timer receives a signal to start timing a diaper-change episode before, after or simultaneously with the receipt of a corresponding signal by the perceptible soiled-diaper signal generating means).

As utilized herein, including the claims, the phrase "***distress period***," when used in connection with the generation of a distress signal, means a time period of predetermined duration or bounded random duration beginning immediately or shortly after sensing of a compression. When the end of a distress period is measured from commencement of a compression episode, the distress period should be selected so as to have a longer duration than any anticipated compression episode (*e.g.*, a minimum distress period of 15 seconds when typical compression episodes measured at 5 to 10 seconds) in order to avoid an anomalous situation in which the distress period (*i.e.*, the distress signal) ends before the compression episode (*i.e.*, exertion of the compressive force upon the infant simulator) ends. Alternatively, when the end of a distress period is measured from termination of a compression episode, the distress period may have any desired duration since the distress period, by definition, cannot end before the compression episode ends.

As utilized herein, including the claims, the term "***doll***" means a figure representative of a human being and including at least a portion representing a head and a portion representing a torso. The figure is preferably shaped as an infant and includes arms and legs. Other physical features can be represented as desired, including specifically, but not exclusively, hair, eyes, eye lashes, eyebrows, ears, nose, mouth, hands, fingers, fingernails, areolae, bellybutton, genitalia, feet, toes, toenails, skin pigmentation, and physical deformities.

As utilized herein, including the claims, the phrase "***feeding period***," means the period of time during which the feeding-request signal will be generated and expressed unless the appropriate satisfaction signal (i.e., a feeding signal) is being continuously provided.

As utilized herein, including the claims, the phrase "***feeding-request episode***," refers to the event of feeding the doll in reaction to a demand signal from the doll indicating a desire to be fed. Each feeding-request episode, from the perspective of a care provider, begins when a perceptible feeding-request signal is initiated and ends when feeding is commenced. It is noted for purposes of clarity that this definition is not intended to mandate the specific signal received by the feeding-request module for initiating or arresting the timing of a feeding-request episode (*e.g.*, timing of a feeding-request episode can be initiated by a signal emanating from the feeding-request interval timer or a signal generated by the perceptible feeding-request signal generating means), nor specify the particular sequence by which an electrical signal must travel through the feeding-request module (*e.g.*, the feeding-request module may be configured and arranged so that the feeding-request duration timer receives a signal to start timing a feeding-request episode before, after or simultaneously with the receipt of a corresponding signal by the perceptible feeding-request signal generating means).

As utilized herein, including the claims, the term "***infant***" refers to a young human being ranging in age from a newborn, including a premature newborn, to an approximately one year old child.

As utilized herein, including the claims, the term "***key***" refers to any device configured and arranged to fit within and communicate with a complementary keyhole, including specifically, but not exclusively a passkey of specified configuration, a card having holes in a specified pattern, a card bearing information on a magnetic strip, a magnet of specified strength and configuration, etc.

As utilized herein, including the claims, the phrase "***predetermined value***" means a specific value (e.g., 10 minutes) and includes both permanently assigned values (*e.g.*, a duration period which is always 10 minutes) and values assigned for an assignment period and capable of being reassigned for subsequent assignment periods

(*e.g.*, a time interval predetermined at the start of an assignment period as 2, 5 or 7 minutes).

As utilized herein, including the claims, the phrase "***random variable***" is used in accordance with the dictionary definition of random variable (*i.e.*, a variable that is a function of the result of a statistical experiment in which each outcome has a definite probability of occurrence, such as the number of spots showing if two dice are thrown). The phrase ***"bounded random variable"*** means that the random variable must fall within defined minimum and maximum values (i.e., the variable must greater than 0 and less than 13.)

As utilized herein, including the claims, the term "***restricted***" means limited access, with access generally achievable only upon the exercise of intentional and deliberate actions directed toward the objective of achieving such access (*e.g.*, removing a machine screw, cutting a closure band, entering an access code, removing a tamper indicating label, etc.).

As utilized herein, including the claims, the phrase "***rocking period***," means the period of time during which the rocking-request signal will be generated and expressed unless the doll is continuously rocked.

As utilized herein, including the claims, the phrase "***rocking-request episode***," refers to the event of rocking the doll in reaction to a demand signal from the doll indicating a desire to be rocked. Each rocking-request episode, from the perspective of a care provider, begins when a perceptible rocking-request signal is initiated and ends when rocking is commenced. It is noted for purposes of clarity that this definition is not intended to mandate the specific signal received by the rocking-request module for initiating or arresting the timing of a rocking-request episode (*e.g.*, timing of a rocking-request episode can be initiated by a signal emanating from the rocking-request interval timer or a signal generated by the perceptible rocking-request signal generating means),

nor specify the particular sequence by which an electrical signal must travel through the rocking-request module (*e.g.*, the rocking-request module may be configured and arranged so that the rocking-request duration timer receives a signal to start timing a rocking-request episode before, after or simultaneously with the receipt of a corresponding signal by the perceptible rocking-request signal generating means).

As utilized herein, including the claims, the phrases "***adjusting the potential duration of a period,***" and "***adjusting the potential duration of a time interval***" means changing the probability of occurrence such that a longer or shorter duration is more likely to occur. Such adjustment can occur by (i) changing one or both of the endpoints of the time range from which the duration of the period or interval can be selected (*e.g.*, a change from a 10 to20 minute time range to a 10 to 50 minute time range or a change from a 10 to 20 minute time range to a 40 to 50 minute time range), and/or (ii) changing the statistical preference for a time value within a defined time range (*e.g.*, a change from a 10 to20 minute time range with a 40% chance of selecting a duration of 15 to 20 minutes to a 10 to20 minute time range with an 80% chance of selecting a duration of 15 to 20 minutes).

As utilized herein, including the claims, the phrase "***perceptible signal***" means any and all means of communication capable of conveying notice or warning to a care provider, including specifically, but not exclusively audible signals (*e.g.*, crying), olfactory signals (*e.g.*, emission of odorous gas), tactile signals (*e.g.*, wet diaper), visual signals (*e.g.*, gesture), and multimedia signals (*e.g.*, crying and tears).

As utilized herein, including the claims, the phrase "***substantially identical signals***," refers to signals perceived by the same sense (*e.g.*, audible signals) and of the same general type (e.g., crying sound, shaking body, floral smell, etc.) with some aspect of the signals perceptibly different (e.g., different pitch, different rate, different intervals between repetitions, different volumes, etc.).

As utilized herein, including the claims, the phrase "***thermal exposure episode***," means the time period beginning when a sensed temperature falls outside a defined acceptable temperature range and ending when a subsequently sensed temperature falls within the defined acceptable temperature range.

Nomenclature

05	Infant Simulator
10	Doll
11	Head
12	Torso
13	Arms
14	Legs
16	Back of Doll
20	Central Microcontroller Unit
21	Tamper Indicating Label
30	Position Sensor
40	Temperature Sensor
50	Compression Sensing System
51	Electrical Circuit
51a	First Contact
51b	Second Contact
60	Diaper
60a	First Diaper
60b	Second Diaper
61	Magnet Attached to Diaper
62	Diaper-Change Switches
62a	First Diaper-Change Switch
62b	Second Diaper-Change Switch
70	Motion Sensor (Rocking, Burping and Abuse)
80	Bottle
80n	Nipple of Bottle
81	Magnet Attached to Bottle
82	Feed Switch
90	Identification Key
91	Tamper Indication Bracelet
100	Initiation Module
110	Position Sensing Module
120	Temperature Sensing Module
130	Compression Sensing Module

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140	Diaper-Change Module
150	Rocking Module
160	Feeding Module
170	Burping Module
180	Fussy Module
190	Assignment Period Module
210	Demand Signal Generating Feature
220	Recording Feature
230	Contented Signal Feature
240	Escalating Demand Signal Feature
250	Identification System Feature
260	Multiple Time Interval Duration Feature
270	Multiple Period Duration Feature
$\mathbf{S_1}$	Repositioning-Request Signal Generated by the Infant Simulator
$\mathbf{S_2}$	Thermal Exposure Signal Generated by the Infant Simulator
$\mathbf{S_3}$	Distress Signal Generated by the Infant Simulator
$\mathbf{S_4}$	Soiled-Diaper Signal Generated by the Infant Simulator
$\mathbf{St_4}$	Diaper-Change Satisfaction Signal Provided by Care Provider
$\mathbf{St_4^+}$	First Diaper-Change Satisfaction Signal
$\mathbf{St_4^-}$	Second Diaper-Change Satisfaction Signal
$\mathbf{S_5}$	Rocking-Request Signal Generated by the Infant Simulator
$\mathbf{St_5}$	Rocking-Request Satisfaction Signal Provided by Care Provider
$\mathbf{S_6}$	Feeding-Request Signal Generated by the Infant Simulator
$\mathbf{St_6}$	Feeding-Request Satisfaction Signal Provided by Care Provider
$\mathbf{S_7}$	Burping-Request Signal Generated by the Infant Simulator
$\mathbf{St_7}$	Burping-Request Satisfaction Signal Provided by Care Provider
$\mathbf{S_8}$	Fussy Signal Generated by the Infant Simulator
+	Positive ("Contented") Signal Generated by Infant Simulator
$\mathbf{S^{ID}}$	Identification Signal
$\mathbf{Sw^{ID}}$	Identification Switch
$\hookrightarrow$	Bypass

Construction

As shown in Figure 1, the infant simulator **05** comprises a doll **10** having a recess (unnumbered) within the back **16** of the doll **10** capable of retaining a central microcontroller unit **20** and a battery pack **25** for powering the central microcontroller unit **20**.

A lock-and-key system (not shown) or tamper indicating device, such as a tamper indicating label **21**, can be provided for purposes of signaling and/or recording efforts to remove or otherwise access the central microcontroller unit **20** and/or battery pack **25** from the doll **10**.

The doll **10** preferably has the appearance of a young infant (*e.g.*, approximately 40 to 80 cm in length and approximately 3 to 5 kg in weight) with a head **11**, torso **12**, arms **13**, and legs **14**. The doll **10** can be sculpted to depict the skin color and facial feature of various ethnic groups including specifically, but not exclusively, African American, Asian, Caucasian, Hispanic, and Native American.

The infant simulator **05** can include a variety of modules designed to emulate the care requirements of an infant. These modules include (i) a position sensing module **110**, (ii) a temperature sensing module **120**, (iii) a compression sensing module **130**, (iv) a diaper-change module **140**, (v) a rocking module **150**, (vi) a feeding module **160** with or without an associated burping module **170**, and (vii) a fussy module **180**. The infant simulator **05** can be designed and programmed with any combination of the described modules, including the ability ~~the~~ to selectively activate and deactivate individual modules for each assignment period.

The infant simulator **05** is equipped to record the quality of care and responsiveness of a person caring for the infant simulator **05** and/or signal the person caring for the infant simulator **05** when care is required.

The modules can be conveniently grouped into the categories of (i) environmental condition sensors, and (ii) episodic events. In addition, the specifics of each episodic event can be adjusted by the use of one or more ancillary features which can be programmed into the central microcontroller unit **20**.

Environmental Conditions

The environmental consitions of abuse, position, temperature and/or compression can be sensed and reported.

Abuse Sensing System

The infant simulator **05** can be equipped with a motion sensor **70** capable of detecting physical abuse of the doll **10** such as by shaking, striking or throwing of the infant simulator **05**. Such an abuse sensing system is described in United States Patent No. 5,443,388 issued to Jurmain et al.

A number of different types and styles of motion sensors **70** may be effectively used to sense and report abuse. One such sensor, capable of providing variable output dependent upon the force of the motion to which the infant simulator **05** is subjected, is a magnetic field induced shock sensor manufactured by Directed Electronics, Inc. under Part No. 504IC wherein movement of a magnet, resulting from a corresponding movement of the doll **10**, generates an electrical current in an induction coil, with the strength of the electrical current proportional to the speed and distance traveled by the magnet. The motion sensor **70** is electrically connected to the central microcontroller unit **20** wherein the strength of the electrical current generated by the motion sensor **70** can be checked against predefined threshold limitations for producing different signals dependent upon the strength of the electrical current. This permits the single motion sensor **70** to differentiate between a modest force, such as produced by normal handling, rocking and burping of the infant simulator **05**, and excessive force, such as experienced when the infant simulator **05** is thrown, shaken or otherwise abused. When motion of the appropriate amplitude is sensed, an electrical ~~satisfaction~~ abuse signal is sent to the central microcontroller unit **20** and an abuse event reported.

The same motion sensor **70** can be effectively used to sense rocking and patting as well as abuse.

*Position Sensing System **30***

The infant simulator **05** can be equipped with a position sensor **30**, such as a mercury switch or roller ball switch, capable of sensing the vertical and horizontal positioning of the infant simulator **05** and communicating the sensed position as between an acceptable position (switch open) and an unacceptable position (switch closed) to the central microcontroller unit **20**. Acceptable positioning includes laying on its back or left side, while unacceptable positioning includes laying face down or upside down. Suitable positioning sensors are available from a number of manufacturers. One suitable position sensing switch is an SPST SMT normally open switch manufactured by ITT Canon under Part No. KSC421JD.

In order to avoid the sensing of routine handling as an unacceptable positioning of the infant simulator **05**, the central microcontroller unit **20** is preferably programmed with a threshold time value, such as 3 to 10 seconds, which must be exceeded before a sensed unacceptable positioning is reported and/or recorded as an unacceptable positioning of the infant simulator **05**.

In a first embodiment, a recording function within the central microcontroller unit **20** records occurrences of unacceptable positioning for later review by the teacher or program administrator. The specific information recorded and reported by the central microcontroller unit **20** can range from the relatively simple to the complex. For example, the central microcontroller unit **20** can be programmed to simply record and report that the infant simulator **05** was unacceptably positioned at least once during the assignment period. Alternatively, the central microcontroller unit **20** can record the number of times the infant simulator **05** was unacceptably positioned and the

duration of each occurrence. A nonexhaustive list of options for recording and reporting positioning data is set forth in Table One, provided below.

TABLE ONE

(OPTIONS FOR RECORDING AND REPORTING UNACCEPTABLE POSITIONING DATA)

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
1	Records and reports only fact that the infant simulator was unacceptably positioned at least once during the assignment period.	YES/NO	Light ON/OFF
2	Records and reports the number of times the infant simulator was unacceptably positioned.	Number	"5."
1	Records and reports total amount of time the infant simulator was unacceptably positioned during an assignment period.	Minutes	45
3	Records and reports the number of times the infant simulator was unacceptably positioned and the total amount of time the infant simulator was unacceptably positioned.	#/Minutes	5:45

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
3	Records and reports the number of times the infant simulator was unacceptably positioned, the total amount of time the infant simulator was unacceptably positioned, and the mean duration of each occurrence.	#/Minutes Minutes	5:45 03
3	Records and reports the amount of time the infant simulator remained in an unacceptable position for each occurrence during an assignment period.	#/Minutes	1: 03 2: 18 3: 20 4: 02 5: 02
4	Records and reports the number of times the infant simulator was unacceptably positioned, the total amount of time the infant simulator was unacceptably positioned, and the amount of time the infant simulator remained in an unacceptable position for each occurrence during an assignment period.	#/Minutes Minutes	5: 45 03:18:20:02:02

In a second embodiment, the central microcontroller unit **20** is connected to a system (not shown) capable of generating a repositioning-request signal $\mathbf{S_1}$, such as an audible cry or scream. The central microcontroller unit **20** is programmed to generate the repositioning-request signal $\mathbf{S_1}$ whenever the infant simulator **05** is placed in an unacceptable position (*e.g.*, laying face down or upside down) and left in that position

beyond a minimum threshold time period (*e.g.*, ten seconds). Generation of the repositioning-request signal S_1 warns the person caring for the infant simulator **05** that the infant simulator **05** is in an improper position and corrective action is required. The repositioning-request signal S_1 and timing of the positioning-request episode can be terminated by simply repositioning the infant simulator **05** into an acceptable position, thereby opening the position sensor **30** and terminating transmission of an electrical signal from the position sensor **30** to the central microcontroller unit **20**.

The central microcontroller unit **20** can be programmed to generate the repositioning-request signal S_1 only at the beginning of each occurrence of improper positioning (*i.e.*, generate a three second signal once the infant simulator **05** is sensed in an unacceptable position for longer than the minimum threshold time period), periodically throughout an improper positioning occurrence, or continuously throughout an improper positioning occurrence.

A preferred embodiment of the position sensing system **30** combines both the recording and signaling systems.

The repositioning-request signal S_1 may be intensified, in accordance with the ancillary feature of providing an escalated demand signal **240**, based upon an increase in the length of time the infant simulator **05** is unacceptably positioned. An example of each is set forth in Table Two, provided below.

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TABLE TWO

(ESCALATING REPOSITIONING-REQUEST SIGNAL)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	LENGTH OF TIME INFANT SIMULATOR REMAINS IN AN UNACCEPTABLE POSITION (MINUTES)
1st Intensity (soft cry)	< 10
2nd Intensity (loud cry)	> 10

*Temperature Sensing System **40***

The infant simulator **05** can be equipped with a temperature sensor **40**, such as a simple thermocouple, capable of sensing the environmental temperatures to which the infant simulator **05** is exposed and communicating the sensed temperatures to the central microcontroller unit **20**.

In a first embodiment, a recording function within the central microcontroller unit **20** records the sensed temperatures for later review by the teacher or program administrator. The specific information recorded and reported by the central microcontroller unit **20** can range from the relatively simple to the complex. For example, the central microcontroller unit **20** can be programmed to simply record and report whether the sensed environmental temperature fell outside a defined acceptable temperature range (*e.g.*, 10°C and 40°C, preferably 15°C and 35 °C) at least once during the assignment period. Alternatively, the central microcontroller unit **20** can record temperature values every two minutes throughout an entire assignment period and

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graphically report the recorded temperatures at the end of the assignment period. A nonexhaustive list of options for recording and reporting thermal exposure data is set forth in Table Three, provided below.

TABLE THREE

(OPTIONS FOR RECORDING AND REPORTING THERMAL EXPOSURE DATA)

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
1	Records only fact that sensed temperature fell outside of acceptable temperature range at least once (i.e. thermal exposure episode occurred).	YES/NO	Light ON/OFF
2	Records number of thermal exposure episodes.	Number	"3."
3	Records high and low temperature extremes.	°C	22°C: 49°C.
4	Records high and low temperature extremes experienced during all thermal exposure episodes.	°C	*°C: 49 °C.
5	Records the number and temperature extreme for each thermal exposure episode.	°C	1: 42°C 2: 44°C 3: 53°C 4: 8° C

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
6	Records the number and duration of each thermal exposure episode.	# / Minutes	1: 06 2: 18 3: 02 4: 02 5: 02
7	Records the number of thermal exposure episodes and continuously records the temperature throughout a thermal exposure episode.	# /°C	**1**:07, 07, 06, 07, 08, 06, 04, 03, 05, 07. **2**: 41, 43, 45, 46, 47, 47, 47, 47, 45, 42, 41.
8	Continuously records the temperature throughout an assignment period.	Minutes/°C	02: 27 04: 27 06: 28 08: 29 10: 28

In a second embodiment, the central microcontroller unit **20** is programmed with defined upper and lower temperature limits (*e.g.*, 10°C and 40°C, preferably 15°C and 35 °C) and connected to a system (not shown) capable of generating a perceptible thermal exposure signal $\mathbf{S_2}$. The central microcontroller unit **20** is programmed to generate the perceptible thermal exposure signal $\mathbf{S_2}$ when the sensed temperature falls outside the acceptable temperature range. Generation of the perceptible

thermal exposure signal S_2 warns the person caring for the infant simulator **05** that the environmental temperature has reached an unacceptable level and corrective action is required. The thermal exposure signal S_2 and timing of the thermal exposure episode can be terminated by removing the infant simulator **05** from the unacceptably warm or cold environment (e.g., removing the infant simulator **05** from the car), thereby returning the body temperature of the infant simulator **05** to an acceptable temperature and ceasing transmission of an electrical signal from the temperature sensor **40** to the central microcontroller unit **20**.

A preferred embodiment of the temperature sensor module combines both the recording and signaling systems.

The central microcontroller unit **20** can be programmed to generate the perceptible thermal exposure signal S_2 only at the beginning of a thermal exposure episode (*i.e.*, generate a ten second signal as soon as a sensed temperature falls outside the acceptable temperature range), periodically throughout a thermal exposure episode (*e.g.*, generate a two second signal every minute once the sensed temperature falls outside the acceptable temperature range until the sensed temperature returns to the acceptable temperature range), or continuously throughout a thermal exposure episode.

The thermal exposure signal S_2 may be intensified, in accordance with the ancillary feature of providing an escalated demand signal **240**, based upon (i) an increase in the difference between the sensed temperature and the temperature limit, and/or (ii) an increase in the duration of the thermal exposure episode. An example of each is set forth in Table Four, provided below.

TABLE FOUR

(ESCALATING THERMAL-DISCOMFORT SIGNAL)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	THERMAL EXPOSURE DURATION (MINUTES)	TEMPERATURE BEYOND ACCEPTABLE LIMIT (°C)
1st Intensity (whimper)	< 5	< 5
2nd Intensity (scream)	5 to 10	5 to 10
3rd Intensity (shriek)	>10	>10

The temperature sensor **40**, as with the central microcontroller unit **20** and battery pack **25**, is preferably equipped with a tamper indicating device (not shown) for purposes of signaling and/or recording efforts to remove or otherwise access the temperature sensor **40**.

*Compression Sensing System **50***

The infant simulator **05** can be equipped with a compression sensing system **50** capable of sensing compression of the doll **10**, such as squeezing of the doll's head **11**, arms **13** and/or legs **14**, and communicating any sensed compression to the central microcontroller unit **20**.

Referring to Figure 3, a compression sensing system **50** is provided in the head **11** of the doll **10** for sensing squeezing or striking of the head **11**. The head **11** is constructed of a pliant material, such as a soft vinyl material, with a normally open electrical circuit **51** provided within the head **11**. The first contact **51a** of the electrical circuit **51** is a thin layer of conductive material laminated to the inside surface

(unnumbered) of the head **11** such that the conductive material moves in concert with the head **11** when the head **11** is deformed The second contact **51b** of the electrical circuit **51** is a cage of conductive material inwardly spaced from the first contact **51a** of the electrical circuit **51**. The spacing between the first **51a** and second **51b** contacts of the normally open electrical circuit **51** is selected so that the contacts **51a** and **51b** will engage one another and close the electrical circuit **51** when the head **11** is subjected to a compressive force or an impact force reflective of abusive squeezing or striking of the head **11**. Spacing between the first **51a** and second **51b** contacts should be selected so that the compression sensing system **50** will consistently sense compressive and impact forces reflective of abuse without sensing compressive and impact forces reflective of normal handling. The spacing necessary to achieve these desired sensing parameter is dependent upon a number of factors, including the type of material used to construct the head **11**, the thickness of the material forming the head **11**, the size and shape of the head **11**, the flexibility of the material laminated to the inside surface of the head **11** to form the first contact **51a**, etc. By way of illustration, when the head **11** is molded from approximately ¼ inch thick plasticized polyvinyl chloride, and the first contact **51a** is a 3 to 4 mil thick aluminum foil, a spacing of approximately ½ to 1 inch should generally provide the desired sensing parameters (*i.e.*, consistently sensing compressive and impact forces reflective of abuse without sensing compressive and impact forces reflective of normal handling).

Optionally, a flexible second cage (not shown) comprising a third contact (not shown) could be positioned intermediate the first **51a** and second **51b** contacts to form a secondary electrical circuit (not shown) with the first contact **51a** in electrical communication with the central microcontroller unit **20**. The third contact (not shown) would be constructed of a material sufficiently flexible to permit the first **51a** and third (not shown) contacts to engage the second contact **51b** when the head **11** experienced an abusive level of compressive or impact force. When such a secondary electrical circuit (not shown) is employed, the compression sensing system **50** is capable of sensing different levels of compressive or impact force (*e.g.*, the secondary circuit is closed when

a "mild" or 'low" compressive or impact force is experienced while the primary circuit **51** is closed when an "abusive" or 'high" compressive or impact force is experienced).

In a first embodiment, a recording function within the central microcontroller unit **20** records sensed compression episodes for later review by the teacher or program administrator. The specific information recorded and reported by the central microcontroller unit **20** can range from the relatively simple to the complex. For example, the central microcontroller unit **20** can be programmed to simply record and report the occurrence of at least one sensed compression episode during the assignment period. Alternatively, the central microcontroller unit **20** can record and report the number of sensed compression episodes occurring during an assignment period and the duration of each sensed compression episode. A nonexhaustive list of options for recording and reporting compression episode data is set forth in Table Five, provided below.

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TABLE FIVE

(OPTIONS FOR RECORDING AND REPORTING COMPRESSION EPISODE DATA)

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
1	Records occurrence of first compression episode only.	YES/NO	Light ON/OFF
2	Records number of separate compression episodes.	Number	"3."
3	Records maximum level of compressive force sensed during an assignment period.	Force Level (Low/High)	High

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
5	Records the number of compression episodes sensed during an assignment period and the maximum level of compressive force sensed for each compression episode.	# Force Level (Low/High)	1: Low 2: Low 3: High 4: Low
6	Records the number and duration of each compression episode sensed during an assignment period.	# / Seconds	1: 01 2: 01 3: 08 4: 02

In a second embodiment, the central microcontroller unit **20** is connected to a system (not shown) capable of generating a perceptible distress signal S_3, such as an audible cry or scream. The central microcontroller unit **20** is programmed to generate the perceptible distress signal S_3 when compression is sensed. Generation of the perceptible distress signal S_3 warns the person caring for the infant simulator **05** that the infant simulator **05** has been subjected to injurious compression or impact. The distress signal S_3 can be terminated, optionally after an appropriate delay, and timing of the compression episode ended, by removing the external event responsible for the compression or impact (*e.g.*, removing the hand of a young sibling squeezing the head **11** of the infant simulator **05**), thereby reopening the compression sensing electrical circuit **51** and terminating transmission of an electrical signal from the electrical circuit **51** to the central microcontroller unit **20**.

The central microcontroller unit **20** can be programmed to generate the perceptible distress signal S_3 only at the beginning of a compression episode (*i.e.*,

generate a three second signal as soon as a compression episode is sensed), continuously throughout a compression episode, or continuously throughout a compression episode and for an additional time period after compression of the infant simulator **05** has ceased for purposes of simulating injury to the infant simulator **05**.

A preferred embodiment of the compression sensing system **50** combines both the recording and signaling systems.

The distress signal S_3 may be intensified, in accordance with the ancillary feature of providing an escalating demand signal **240**, based upon (i) an increase in the maximum sensed compressive force , and/or (ii) an increase in the duration of the compression episode. An example of each is set forth in Table Six, provided below.

TABLE SIX

(ESCALATING DISTRESS SIGNAL)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	COMPRESSION EPISODE DURATION (SECONDS)	COMPRESSIVE FORCE ~~(°C)~~
1st Intensity (cry)	< 5	Low
2nd Intensity (scream)	> 5	High

EPISODIC EVENTS

Diaper-Change Event

The central microcontroller unit **20** can be programmed to effect periodic diaper-change episodes, wherein the student caring for the infant simulator **05** is signaled by the infant simulator **05**, on a schedule unknown to the student, that the diaper **60** on the infant simulator **05** needs to be changed. Preferred soiled-diaper signals S_4 include an audible cry and/or a wetting of the diaper **60**.

The time interval between diaper-change periods can be a bounded random variable (*e.g.*, occurring every 30 to 120 minutes) or a predetermined variable (*e.g.*, sequentially occurring at intervals of 30, 90, 30, 30, 120, 60, 20 and 90 minutes). In order to more accurately emulate the care requirements of an actual infant, and prevent students from memorizing the schedule of events, it is generally preferred to control the time interval between events as a bounded random variable. Alternatively, multiple predefined programs, each providing a different fixed schedule of events, can also be realistically employed so long as the students do not know which program has been selected (*i.e.,* the schedule of events is random from the perspective of the student) and the number of programs is sufficient to prevent the students from memorizing one or two different schedules and thereafter being able to partially defeat the purpose of the program by ignoring the infant simulator **05** between scheduled events.

Referring to Figure 3, the infant simulator **05** can include a pair of oppositely mounted, normally open Hall Effect switches **62a** and **62b** (hereinafter diaper-change switches), within the torso **12** of the doll **10**. A wide variety of suitable Hall Effect switches **62** are available from a number of different manufacturers, including Hall Effect switch Model No. DN 6851 manufactured by Panasonic. The diaper-change switches **62** are electrically connected to the central microcontroller unit **20**. Because the diaper-change switches **62** are mounted in reverse directions within the doll **10**, the first

diaper-change switch **62a** is closed only by a magnet **61** having a "north" facing polarity, while the second diaper-change switch **62b** is closed only by a magnet **61** having a "south" facing polarity.

Referring to Figures 4a and 4b, the student caring for the infant simulator **05** is provided with two diapers **60** sized to fit the infant simulator **05**. A magnet **61** is sewn into each of the diapers **60** at a position effective for placing the magnet **61** in close proximity to the appropriate diaper-change switch **62** when the diaper **60** is fitted onto the doll **10**. The magnet **61** in the first diaper **60a** is rotated so that the magnet **61** has a "north" facing polarity when the first diaper **60a** is fitted onto the doll **10**, while the magnet **61** in the second diaper **60b** is rotated so that the magnet **61** has a "south" facing polarity when the second diaper **60b** is fitted onto the doll **10**. When the appropriate diaper-change switch **62** is closed, an electrical satisfaction signal is sent to the central microcontroller unit **20** and the soiled-diaper signal S_4 is arrested. Timing of the diaper-change episode is also terminated.

The central microcontroller unit **20** initiates a diaper-change episode by alternating the "selected" diaper-change switch **62** as between the first **62a** and second **62b** diaper-change switches, and initiating generation of a perceptible soiled-diaper signal S_4. In order to arrest the soiled-diaper signal S_4, the student must close the newly selected diaper-change switch **62** by changing the diaper **60**.

The central microcontroller unit **20** preferably includes a recording function for recording relevant diaper-change episode data for later review by the teacher or program administrator. The specific information recorded by the central microcontroller unit **20** can range from the relatively simple to the complex. For example, the central microcontroller unit **20** can be programmed to simply record and report the total duration of all diaper-change episodes. Alternatively, the central microcontroller unit **20** can record and report the total number of diaper-change episodes which occurred during an assignment period and the duration of each individual diaper-

change episode. A nonexhaustive list of options for recording and reporting relevant diaper-change episode data is set forth in Table Seven, provided below.

TABLE SEVEN

(OPTIONS FOR RECORDING AND REPORTING DIAPER-CHANGE EPISODE DATA)

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
1	Records and reports total duration of all diaper-change episodes occurring throughout an assignment period.	Minutes	45
2	Records and reports number of diaper-change episodes and total duration of all diaper-change episodes occurring throughout an assignment period.	#/Minutes	5:45
3	Records and reports number of diaper-change episodes, total duration of all diaper-change episodes occurring throughout an assignment period, and mean duration of the diaper-change episodes.	#/Minutes Minutes	5:45 03
3	Records and reports duration of each diaper-change episode occurring throughout an assignment period.	#/Minutes	1: 03 2: 18 3: 20 4: 02 5: 02

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
4	Records and reports number of diaper-change episodes, total duration of all diaper-change episodes occurring throughout an assignment period, and duration of each diaper-change episode occurring throughout an assignment period.	#/Minutes Minutes	5: 45 03:18:20:02:02

The central microcontroller unit **20** can be programmed to generate the perceptible soiled-diaper signal $\mathbf{S_4}$ only at the beginning of a diaper-change period (*i.e.*, generate a ten second signal when a diaper-change period is initiated by the central microcontroller unit **20**), periodically throughout a diaper-change period (*e.g.*, generate a two second signal every minute once a diaper-change period is initiated by the central microcontroller unit **20**), or continuously throughout a diaper-change period.

The soiled-diaper signal $\mathbf{S_4}$ may be intensified, in accordance with the ancillary feature of providing an escalating demand signal **240**, based upon an increase in the duration of the diaper-change episode. An example is set forth in Table Eight, provided below.

TABLE EIGHT

(ESCALATING SOILED DIAPER SIGNAL)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	**DIAPER-CHANGE EPISODE DURATION (MINUTES)**
1st Intensity (soft cry)	< 10
2nd Intensity (loud cry)	> 10

Rocking Event

The central microcontroller unit **20** can be programmed to effect periodic rocking-request episodes, wherein the student caring for the infant simulator **05** is signaled by the infant simulator **05**, on a schedule unknown to the student, to provide the infant simulator **05** with attentive care in the form of rocking. Preferred types of rocking-request signals $\mathbf{S_5}$ include crying, whimpering, fidgeting and combinations thereof.

The time interval between rocking periods can be a bounded random variable (*e.g.*, occurring every 30 to 120 minutes) or a predetermined variable (*e.g.*, sequentially occurring at intervals of 30, 90, 30, 30, 120, 60, 20 and 90 minutes). In order to more accurately emulate the care requirements of an actual infant, and prevent students from memorizing the schedule of events, it is generally preferred to control the time interval between events as a bounded random variable. Alternatively, multiple predefined programs, each providing a different fixed schedule of events, can also be realistically employed so long as the students do not know which program has been selected (*i.e.,* the schedule of events is random from the perspective of the student) and the number of programs is sufficient to prevent the students from memorizing one or two

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different schedules and thereafter being able to partially defeat the purpose of the program by ignoring the infant simulator **05** between scheduled events.

Referring to Figure 3, the infant simulator **05** can include a motion sensor **70** within the torso **12** of the doll **10** effective for sensing rocking of the infant simulator **05**. A number of different types and styles of motion sensors **70** may be effectively used. One such sensor, capable of providing variable output dependent upon the force of the motion to which the infant simulator **05** is subjected, is a magnetic field induced shock sensor manufactured by Directed Electronics, Inc. under Part No. 504IC wherein movement of a magnet, resulting from a corresponding movement of the doll **10**, generates an electrical current in an induction coil, with the strength of the electrical current proportional to the speed and distance traveled by the magnet. The motion sensor **70** is electrically connected to the central microcontroller unit **20** wherein the strength of the electrical current generated by the motion sensor **70** can be checked against predefined threshold limitations for producing different signals dependent upon the strength of the electrical current. This permits the single motion sensor **70** to differentiate between a modest force, such as produced by normal handling, rocking and burping of the infant simulator **05**, and excessive force, such as experienced when the infant simulator **05** is thrown, shaken or otherwise abused. When motion of the appropriate amplitude is sensed, an electrical satisfaction signal is sent to the central microcontroller unit **20** and the rocking-request signal $\mathbf{S_5}$ is arrested. Timing of the rocking-request episode is also terminated.

The central microcontroller unit **20** initiates a rocking-request episode by initiating generation of a perceptible rocking-request signal $\mathbf{S_5}$. In order to arrest the rocking-request signal $\mathbf{S_5}$, the student must rock the infant simulator **05** with sufficient force to generate an appropriate electrical current in the motion sensor **70** (*i.e.*, sufficient to signal "rocking" but insufficient to signal "abuse").

The central microcontroller unit **20** can be programmed to either terminate or inhibit generation of the rocking-request signal S_5 once rocking is sensed. When the termination option is selected, the student need only rock the infant simulator **05** for some minimum time period (*e.g.*, two to ten seconds) sufficient to ensure that rocking has been sensed, after which the student may stop rocking the infant simulator **05** and the rocking-request signal S_5 will not begin again. When the inhibition option is selected, the student must continuously rock the infant simulator **05** throughout the rocking period (*e.g.*, five to twenty minutes) to prevent the rocking-request signal S_5 from being generated. The inhibition option is generally preferred as it more closely emulates the care requirements of an actual infant.

The central microcontroller unit **20** preferably includes a recording function for recording relevant rocking-request episode data for later review by the teacher or program administrator. The specific information recorded by the central microcontroller unit **20** can range from the relatively simple to the complex. For example, the central microcontroller unit **20** can be programmed to simply record and report the total duration of all rocking-request episodes. Alternatively, the central microcontroller unit **20** can record and report the total number of rocking-request episodes which occurred during an assignment period and the duration of each individual rocking-request episode. A nonexhaustive list of options for recording and reporting relevant rocking-request episode data is set forth in Table Nine, provided below.

TABLE NINE

(OPTIONS FOR RECORDING AND REPORTING

ROCKING-REQUEST EPISODE DATA)

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
1	Records and reports total duration of all rocking-request episodes occurring throughout an assignment period.	Minutes	45
2	Records and reports number of rocking-request episodes and total duration of all rocking-request episodes occurring throughout an assignment period.	#/Minutes	5:45
3	Records and reports number of rocking-request episodes, total duration of all rocking-request episodes, and mean duration of the rocking-request episodes occurring throughout an assignment period.	#/Minutes Minutes	5:45 03
3	Records and reports duration of each rocking-requested episode occurring throughout an assignment period.	#/Minutes	1: 03 2: 18 3: 20 4: 02 5: 02

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Option	**Description**	**Data Recorded**	**Sample Readout**
4	Records and reports number of rocking-request episodes, total duration of all rocking-request episodes, and duration of each rocking-request episode occurring throughout an assignment period.	#/Minutes Minutes	5: 45 03:18:20:02:02

The central microcontroller unit **20** can be programmed to generate the perceptible rocking-request signal $\mathbf{S_5}$ only at the beginning of a rocking period (*i.e.*, generate a ten second signal when a rocking period is initiated by the central microcontroller unit **20**), periodically throughout a rocking period (*e.g.*, generate a two second signal every minute once a rocking period is initiated by the central microcontroller unit **20**), or continuously throughout a rocking period.

The rocking-request signal $\mathbf{S_5}$ may be intensified, in accordance with the ancillary feature of providing an escalating demand signal **240**, based upon an increase in the duration of the rocking-request episode. An example is set forth in Table Ten, provided below.

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TABLE TEN

(ESCALATING ROCKING-REQUEST SIGNAL)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	ROCKING-REQUEST EPISODE DURATION (MINUTES)
1st Intensity (soft cry)	< 10
2nd Intensity (loud cry)	> 10

Feeding Event

The central microcontroller unit **20** can be programmed to effect periodic feeding-request episodes, wherein the student caring for the infant simulator **05** is signaled by the infant simulator **05**, on a schedule unknown to the student, to feed the infant simulator **05**. Preferred types of feeding-request signals S_6 include crying, sucking, outstretched arms **13** and combinations thereof.

The time interval between feeding periods can be a bounded random variable (*e.g.*, occurring every 30 to 120 minutes) or a predetermined variable (*e.g.*, sequentially occurring at intervals of 30, 90, 30, 30, 120, 60, 20 and 90 minutes). In order to more accurately emulate the care requirements of an actual infant, and prevent students from memorizing the schedule of events, it is generally preferred to control the time interval between events as a bounded random variable. Alternatively, multiple predefined programs, each providing a different fixed schedule of events, can also be realistically employed so long as the students do not know which program has been selected (*i.e.,* the schedule of events is random from the perspective of the student) and the number of programs is sufficient to prevent the students from memorizing one or two

different schedules and thereafter being able to partially defeat the purpose of the program by ignoring the infant simulator **05** between scheduled events.

Referring to Figure 3, the infant simulator **05** can include a normally open Hall Effect switch **82** (hereinafter feed switch), within the head **11** of the doll **10** immediately behind the mouth (unnumbered). The feed switch **82** is electrically connected to the central microcontroller unit **20**. The feed switch **82** is normally open, and can be closed only by a magnet **81** having the appropriately directed polarity.

Referring to Figure 5, the student caring for the infant simulator **05** is provided with a bottle **80** scaled to the size of the infant simulator **05.** A magnet **81** is molded into the bottle **80** at a position effective for placing the magnet **81** in close proximity to the feed switch **82** when the bottle **80** is placed against the mouth (unnumbered) of the doll **10**. Alternatively, the magnet **81** can be molded within a key (not shown) bearing indicia representative of a bottle.

The mouth (unnumbered) of the doll **10** can optionally be molded to include a shaped indentation (not shown) into which a correspondingly shaped nipple **80n** on the bottle **80** can be inserted. The shape of the indentation (not shown) and the nipple **80n** are selected so that the bottle **80** must be rotated into a predetermined relationship relative to the head **11** of the doll **10** in order to fit within the indentation (not shown). Such rotation-specific shapes include specifically, but not exclusively, an isosceles triangle, a circular segment, and an "L." When the nipple **80n** of the bottle **80** is fitted within the indentation (not shown) in the mouth (unnumbered) the magnet **81** in the bottle **80** is properly oriented relative to the feed switch **82** and the feed switch **82** is closed. When the feed switch **82** is closed, an electrical satisfaction signal is sent to the central microcontroller unit **20** and the feeding-request signal S_6 arrested. Timing of the feeding-request episode is also terminated.

The central microcontroller unit **20** initiates a feeding-request episode by initiating generation of a perceptible feeding -request signal. In order to arrest the feeding -request signal, the student must "feed" the infant simulator **05** by placing the bottle **80** against the mouth (unnumbered) of the doll **10**.

The central microcontroller unit **20** can be programmed to either terminate or inhibit generation of the feeding-request signal S_6 once the feeding signal is sensed. When the termination option is selected, the student need only feed the infant simulator **05** for some minimum time period (*e.g.*, two to ten seconds) sufficient to ensure that feeding has been sensed, after which the student may stop feeding the infant simulator **05** and the feeding -request signal will not begin again. When the inhibition option is selected, the student must continuously feed the infant simulator **05** throughout the feeding -request period (*e.g.*, five to twenty minutes) to prevent the feeding -request signal from being generated. The inhibition option is generally preferred as it more closely emulates the care requirements of an actual infant.

The central microcontroller unit **20** preferably includes a recording function for recording relevant feeding -request episode data for later review by the teacher or program administrator. The specific information recorded by the central microcontroller unit **20** can range from the relatively simple to the complex. For example, the central microcontroller unit **20** can be programmed to simply record and report the total duration of all feeding-request episodes. Alternatively, the central microcontroller unit **20** can record and report the total number of feeding-request episodes which occurred during an assignment period and the duration of each individual feeding-request episode. A nonexhaustive list of options for recording and reporting relevant feeding-request episode data is set forth in Table Eleven, provided below.

T0500

TABLE ELEVEN

(OPTIONS FOR RECORDING AND REPORTING

FEEDING-REQUEST EPISODE DATA)

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
1	Records and reports total duration of all feeding-request episodes occurring throughout an assignment period.	Minutes	45
2	Records and reports number of feeding-request episodes and total duration of all feeding-request episodes occurring throughout an assignment period.	#/Minutes	5:45
3	Records and reports number of feeding-request episodes, total duration of all feeding-request episodes, and mean duration of the feeding-request episodes occurring throughout an assignment period.	#/Minutes Minutes	5:45 03
3	Records and reports duration of each feeding-request episode occurring throughout an assignment period.	#/Minutes	1: 03 2: 18 3: 20 4: 02 5: 02

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
4	Records and reports number of feeding-request episodes, total duration of all feeding-request episodes, and duration of each feeding-request episode occurring throughout an assignment period.	#/Minutes Minutes	5: 45 03:18:20:02:02

The central microcontroller unit **20** can be programmed to generate the perceptible feeding-request signal $\mathbf{S_6}$ only at the beginning of a feeding period (*i.e.*, generate a ten second signal when a feeding period is initiated by the central microcontroller unit **20**), periodically throughout a feeding period (*e.g.*, generate a two second signal every minute once a feeding period is initiated by the central microcontroller unit **20**), or continuously throughout a feeding period.

The feeding-request signal $\mathbf{S_6}$ may be intensified, in accordance with the ancillary feature of providing an escalating demand signal **240**, based upon an increase in the duration of the feeding-request episode. An example is set forth in Table Twelve, provided below.

T05 20

TABLE TWELVE

(ESCALATING FEEDING-REQUEST SIGNAL)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	FEEDING-REQUEST EPISODE DURATION (MINUTES)
1st Intensity (soft cry)	< 10
2nd Intensity (loud cry)	> 10

Burping Event

The central microcontroller unit **20** can be programmed to effect burping-request episodes, wherein the student caring for the infant simulator **05** is signaled by the infant simulator **05**, on a schedule unknown to the student, to burp the infant simulator **05** after the infant simulator **05** has been feed in response to a feeding-request signal $\mathbf{S_6}$. Burping-request periods can be initiated after the satisfaction of some or all of the feeding periods and is preferably initiated independently of any environmentally sensed conditions (*e.g.*, initiation of a burping period is not contingent upon the student laying the infant simulator **05** face down on the floor after a feeding period). Preferred types of burping-request signals $\mathbf{S_7}$ include crying, whimpering, fidgeting and combinations thereof.

Burping-request periods can be initiated immediately after the end of a satisfied feeding period or after a defined delay (e.g., two to thirty minutes). The delay between the end of a feeding period and initiation of a burping period can be a bounded random variable (*e.g.*, 0 to 30 minutes) or a predetermined variable (*e.g.*, sequentially occurring at intervals of 0, 9, 3, 0, 12, 6, 20 and 9 minutes). In order to more accurately

emulate the care requirements of an actual infant, and prevent students from memorizing and sharing the schedule of events, it is generally preferred to control the length of the delay as a bounded random variable. Alternatively, multiple predefined programs, each providing a different fixed schedule of events including scheduling of burping periods, can also be realistically employed so long as the students do not know which program has been selected (*i.e.,* the schedule of events is random from the perspective of the student) and the number of different delay durations is sufficient to prevent the students from memorizing one or two different delay durations and thereafter being able to partially defeat the purpose of the program by ignoring the infant simulator **05** between sequential feeding and burping events.

Referring to Figure 3, the same motion sensor **70** used for purposes of sensing rocking of the infant simulator **05** can also be effectively used to sense burping of the infant simulator **05** since the type of motion provided by rocking and patting are both detectable by the motion sensor **70**. When motion of the appropriate amplitude is sensed, an electrical satisfaction signal is sent to the central microcontroller unit **20** and the burping-request signal S_7 is arrested. Timing of the burping-request episode is also terminated.

The central microcontroller unit **20** initiates a burping-request episode by initiating generation of a perceptible burping-request signal S_7. In order to arrest the burping-request signal S_7, the student must burp or pat the infant simulator **05** with sufficient force to generate an appropriate electrical current in the motion sensor **70** (*i.e.*, sufficient to signal "patting" but insufficient to signal "abuse").

The central microcontroller unit **20** can be programmed to either terminate or inhibit generation of the burping-request signal S_7 once patting is sensed. When the termination option is selected, the student need only burp the infant simulator **05** for some minimum time period (*e.g.*, two to ten seconds) sufficient to ensure that burping has been sensed, after which the student may stop burping the infant simulator **05** and the burping-

request signal S_7 will not begin again. When the inhibition option is selected, the student must continuously burp the infant simulator **05** throughout the burping period (*e.g.*, two to sixty minutes, preferably five to twenty minutes) to prevent the burping-request signal S_7 from being generated. The inhibition option is generally preferred as it more closely emulates the care requirements of an actual infant.

The micro controller unit **20** can optionally be programmed to generate a "burp" sound at the end of a burping period, provided the requested burping action has been provided during the burping period (*e.g.*, threshold duration of patting provided during burping period), for purposes of providing the student with positive feedback.

The central microcontroller unit **20** preferably includes a recording function for recording relevant burping-request episode data for later review by the teacher or program administrator. The specific information recorded by the central microcontroller unit **20** can range from the relatively simple to the complex. For example, the central microcontroller unit **20** can be programmed to simply record and report the total duration of all burping-request episodes. Alternatively, the central microcontroller unit **20** can record and report the total number of burping-request episodes which occurred during an assignment period and the duration of each individual burping-request episode. A nonexhaustive list of options for recording and reporting relevant burping-request episode data is set forth in Table Thirteen, provided below.

TABLE THIRTEEN

(OPTIONS FOR RECORDING AND REPORTING BURPING-REQUEST EPISODE DATA)

OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
1	Records and reports total duration of all burping-request episodes occurring throughout an assignment period.	Minutes	45
2	Records and reports number of burping-request episodes and total duration of all burping-request episodes occurring throughout an assignment period.	#/Minutes	5:45
3	Records and reports number of burping-request episodes, total duration of all burping-request episodes, and mean duration of the burping-request episodes occurring throughout an assignment period.	#/Minutes Minutes	5:45 03
3	Records and reports duration of each burping-request episode occurring throughout an assignment period.	#/Minutes	1: 03 2: 18 3: 20 4: 02 5: 02

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OPTION	DESCRIPTION	DATA RECORDED	SAMPLE READOUT
4	Records and reports number of burping-request episodes, total duration of all burping-request episodes, and duration of each burping-request episode occurring throughout an assignment period.	#/Minutes Minutes	5: 45 03:18:20:02:02

The central microcontroller unit **20** can be programmed to generate the perceptible burping-request signal $\mathbf{S_7}$ only at the beginning of a burping period (*i.e.*, generate a ten second signal when a burping period is initiated by the central microcontroller unit **20**), periodically throughout a burping period (*e.g.*, generate a two second signal every minute once a burping period is initiated by the central microcontroller unit **20**), or continuously throughout a burping period.

The burping-request signal $\mathbf{S_7}$ may be intensified, in accordance with the ancillary feature of providing an escalating demand signal **240**, based upon an increase in the duration of the burping-request episode. An example is set forth in Table Fourteen, provided below.

TO570

TABLE FOURTEEN

(ESCALATING BURPING-REQUEST SIGNAL)

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	BURPING-REQUEST EPISODE DURATION (MINUTES)
1st Intensity (soft cry)	< 10
2nd Intensity (loud cry)	> 10

Fussy Event

For purposes of emulating the actions of an actual infant, the central microcontroller unit **20** can be programmed to effect periodic fussy periods, wherein the student caring for the infant simulator **05** is signaled by the infant simulator **05**, on a schedule unknown to the student, to tend to the infant simulator **05**, without an ability to arrest the perceptible signal being generated by the infant simulator **05**. Of course, the implementation of a fussy episode is only meaningful when used in combination with at least one other demand event (*i.e.*, environmental condition and/or episodic event) for which the perceptible signal can be arrested by taking the appropriate action. Fussy events can be interspersed throughout the assignment period as desired for purposes of emulating those times occasionally encountered in real life, when the infant is crying and nothing seems to satisfy the infant.

The central microcontroller unit **20** can be programmed to generate the perceptible fussy signal $\mathbf{S_8}$ only at the beginning of a fussy period (*i.e.*, generate a ten second signal when a fussy period is initiated by the central microcontroller unit **20**), periodically throughout a fussy period (*e.g.*, generate a two second signal every minute

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once a fussy period is initiated by the central microcontroller unit **20**), or continuously throughout a fussy period. Preferred types of fussy signals $\mathbf{S_8}$ include crying, whimpering, whining, coughing, fidgeting and combinations thereof.

The student should be expected to make some effort to satisfy the fussing infant simulator **05**. Handling of the infant simulator **05** can be detected by the same motion sensor **70** used for purposes of sensing rocking and burping of the infant simulator **05**. In the event that no effort is made to satisfy the fussing infant simulator **05**, the fussy signal $\mathbf{S_8}$ may be intensified, in accordance with the ancillary feature of providing an escalating demand signal **240**, based upon a threshold time duration during which the fussy signal $\mathbf{S_8}$ has been generated without any detectable handling. An example is set forth in Table Fifteen, provided below.

The perceptible fussy signal $\mathbf{S_8}$ - normal or intensified - is not arrested once handling is detected. The receipt of an electrical "handling" signal by the central microcontroller unit **20** is effective only for preventing escalation of the perceptible fussy signal $\mathbf{S_8}$. Hence, once the perceptible fussing signal has been intensified, subsequent handling of the infant simulator **05** does not reduce or arrest the perceptible fussy signal $\mathbf{S_8}$.

TABLE FIFTEEN

(ESCALATING FUSSY SIGNAL)

T0580

STRENGTH OF PERCEPTIBLE SIGNAL (AUDIBLE)	**FUSSY DURATION WITHOUT HANDLING (MINUTES)**
1st Intensity (soft cry)	< 10
2nd Intensity (loud cry)	> 10

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ANCILLARY FEATURES

Perceptibly Different Signals

The infant simulator **05** provides a perceptible signal for each of a number of different events, selected from (i) the environmental conditions of position, temperature and compression, and (ii) the episodic events of diaper-change, rocking, feeding, burping, and fussing. The perceptible signal generated for each of these conditions/events can be the same or different. For example, the perceptible signal generated when the infant simulator **05** is unacceptable positioned can be a loud cry, while the perceptible signal generated for requesting to be ~~feed~~ fed and to be rocked can be a whimper. The differences can be significant (*e.g.*, whimpering verses screaming), or subtle (*e.g.*, loud whimpering verses soft crying).

The use of different perceptible signals for different conditions/events serves the desired effect of awarding attentive student by informing such students of the specific satisfaction signal required (*e.g.*, a soft cry signal a need to be rocked while whimpering signals a need to change the diaper **60**). In order to prevent the students from memorizing and sharing such information, the infant simulator **05** can optionally be equipped with an ability for the teacher or other program administrator to change the specific perceptible signal to be generated for each condition/ event at the beginning of each assignment period.

Contented Signal

The microcontroller unit **20** may be programmed to provide a positive response + when the student has appropriately responded to a demand event, (e.g., timely changing a diaper **60** in response to a soiled-diaper signal S_4). The positive response +

can be substantially any perceptible signal recognizable as signaling a happy or contented infant, including specifically, but not exclusively audible signals (*e.g.*, cooing or giggling), olfactory signals (*e.g.*, emission of pleasant scent), visual signals (*e.g.*, smiling, or wiggling of the feet), and multimedia signals (*e.g.*, cooing and smiling).

The positive response + can be scheduled to occur immediately upon satisfaction of the requested activity (e.g., after changing a soiled diaper **60** or at the end of a satisfied burping period) or after a defined time delay (e.g., two minutes after changing a soiled diaper **60** or between 20 seconds and two minutes after a satisfied burping period has ended).

The microcontroller unit **20** may be programmed to provide the positive response + upon the satisfaction of each and every demand event, only upon the satisfaction of selected demand events, or as a bounded random variable (*e.g.*, only after every other satisfied demand event, only after satisfied burping and diaper-change events, or a 20% chance of occurring after each satisfied demand event). A positive response + should not be provided in connection with an environmentally triggered event (*i.e.*, thermal exposure signal $\mathbf{S_2}$ or distress signal $\mathbf{S_3}$) since satisfaction of such signals is based upon removal of an unpleasant stimuli rather than the comforting satisfaction of a need.

*Escalating Demand Signal **240***

The microcontroller unit **20** may be programmed to escalate the strength, intensity and/or severity of the perceptible demand signals generated by the infant simulator **05** as the severity of an environmental condition increases (*e.g.*, the temperature of the infant simulator **05** is more than 5°C greater than a maximum allowable temperature) and/or duration of a demand episode increases (*e.g.*, the demand episode lasts longer than 10 minutes). The escalation can be effected in a variety of ways dependent upon the specific type of signal. For example, an audible cry can be escalated

from a soft cry to a loud cry, or from a cry to a scream. Similarly, a light can be changed from a white light to a red light.

The perceptible demand signal can be escalated through any number of continuous or stepped levels as desired. A simple single stepped escalation - normal to increased - is relatively simple to implement and generally effective for providing the student with appropriate notice that a demand is not being timely satisfied.

Identification System

In order to ensure that the student assigned to care for the infant simulator **05** is at least present when the demands of the infant simulator **05** are being satisfied (*i.e.*, either providing the necessary care themselves or securing the necessary care from someone else at the time the demand event occurs), the infant simulator **05** can be equipped with an identification system (not shown). The identification system (not shown) would prevent a satisfaction signal (*e.g.*, rocking of the infant simulator **05**) from arresting the demand signal (*e.g.*, rocking-request signal S_5) until an identification signal S^{ID} is received by the identification system (not shown).

An exemplary identification system (not shown) includes at least, (i) a means for receiving an identification signal S^{ID} personal to the assigned care-provider, and (ii) a means in communication with the identification-signal receiving means (not shown) and the central microcontroller unit **20** effective for preventing arresting of a demand signal until the identification signal S^{ID} is received by the identification-signal receiving means (not shown).

The means for receiving an identification signal S^{ID} personal to the assigned care-provider can be any of a number of systems or devices capable of identifying and responding only to a unique item or characteristic possessed by the assigned care-provider. A nonexhaustive list of such devices includes (i) a fingerprint

recognition device (not shown), (ii) a voice recognition device (not shown), and (iii) a keyhole (not shown) accepting a uniquely shaped identification key **90** attachable to the wrist of the assigned care provider by a tamper indicating bracelet **91**.

Multiple Behavior Modes

The central microcontroller unit **20** may be programmed to allow a teacher or other program administrator to change the level of care required by the infant simulator **05**. Alternatively, selection of the level can be randomly selected by the central microcontroller unit **20** for each assignment period. These different levels of care can be produced by altering the time interval between events (*i.e.*, increase or decrease the number of events occurring within an assignment period) and/or altering the duration of each event (*i.e.*, increase or decrease the length of each period). The levels of care can be increased and/or decreased through any number of continuous or stepped levels as desired. A convenient program permits the care level to be selected from amongst an easy level (*i.e.*, long intervals and short events), an average level (*i.e.*, modestly long intervals and alternating long and short events), and a difficult level (*e.g.*, short intervals and long events).

EXAMPLE

Figures 2a-j provide a flowchart for one embodiment of each of the modules listed below in Table Sixteen. Each of the modules includes both the demand signal generating feature **210** and the recording feature **220**, except for the fussy module **180** which includes only a demand signal generating feature **210**, and the initiation **100** and assignment period **190** modules which do not include either of these features.

The modules also include each of the ancillary features of contented signal **230**, escalating demand signal **240**, and identification system **250** as listed next to each

module. The ancillary features of multiple time interval durations **260** and multiple period durations **270**, used to create multiple behavior modes, are not shown or depicted in the flowchart as such features are controlled by the central microcontroller unit **20** rather than the individual modules.

Table Sixteen

(Listing of Modules and Ancillary Features)

Module	Reference No.	Ancillary Features
Initiation	**100**	None
Position	**110**	*1.* Escalating Demand Signal
Temperature	**120**	*1.* Escalating Demand Signal
Compression	**130**	*1.* Escalating Demand Signal
Diaper Change	**140**	*1.* Contented Signal *2.* Identification System *3.* Escalating Demand Signal
Rocking	**150**	*1.* Contented Signal *2.* Identification System *3.* Escalating Demand Signal
Feeding	**160**	*1.* Contented Signal *2.* Identification System *3.* Escalating Demand Signal

MODULE	REFERENCE No.	ANCILLARY FEATURES
BURP	170	*1.* Contented Signal *2.* Identification System *3.* Escalating Demand Signal
FUSSY	180	None
ASSIGNMENT PERIOD	190	None

The individual modules can occur in any sequence, with the exception of the initiation module **100** which must occur first, the assignment period module **190** which must occur last, and the burping module **170** which can occur only after satisfaction of the feeding module **160**.

Initiation Module 100

Upon activating the infant simulator **05**, the central microcontroller unit **20** turns the bypass signal ↪ ON, begins timing the assignment period, and begins timing the intervals between successive, diaper-change, rocking, feeding, and fussy periods based upon the program selected and/or preprogrammed into the central microcontroller unit **20**. Based upon the program selected, the central microcontroller unit **20** signals each of the diaper-change **140**, rocking **150**, feeding **160** and fussy **180** modules at the appropriate times to start and stop a corresponding demand period, as represented by © in the flow chart. The central microcontroller unit **20** also commences cycling through each of the modules.

Position Module 110

The position sensor **30** detects the position of the infant simulator **05** as between an acceptable position (*e.g.*, laying on its back or left side) and an unacceptable position (*e.g.*, laying face down or upside down) and signals the position module **110** when the infant simulator **05** is detected in an unacceptable position.

Referring to Figure 2b, the position module **110** is bypassed so long as the infant simulator **05** is in an acceptable position. However, when the position module **110** receives a signal from the position sensor **30** that the infant simulator **05** is in an unacceptable position, the position module **110** initiates generation of the repositioning-request signal $\mathbf{S_1}$ by means of the demand signal generating feature **210** embedded within the module **110**, starts timing the length of time the repositioning-request signal $\mathbf{S_1}$ is generated, and turns OFF the bypass signal ↪.

If the repositioning-request signal $\mathbf{S_1}$ is generated for a predetermined time **x** (*e.g.*, 10 minutes), the position module **110** increases the intensity of the repositioning-request signal $\mathbf{S_1}$ by means of the escalating demand feature **240** embedded within the position module **110**. The repositioning-request signal $\mathbf{S_1}$ is generated at the increased intensity thereafter until the infant simulator **05** is returned to an acceptable position.

Once the infant simulator **05** is returned to an acceptable position, generation of the repositioning-request signal $\mathbf{S_1}$ is turned OFF, the occurrence of a repositioning-request episode is counted, the duration of time during which the infant simulator **05** was in an unacceptable position (*i.e.*, the length of time the repositioning-request signal $\mathbf{S_1}$ was generated) recorded by the recording feature **220**, the repositioning-request episode timer is stopped and reset, the intensity of the repositioning-request signal $\mathbf{S_1}$ is checked and returned to normal if intensified, the bypass signal ↪ is turned back ON, and the position module **110** is exited.

Temperature Module 120

The temperature sensor **40** measures the temperature of the infant simulator **05** and signals the temperature module **120** when the temperature falls outside an acceptable temperature range (*i.e.*, less than 15 °C or greater than 35 °C).

Referring to Figure 2c, the temperature module **120** is bypassed so long as the infant simulator **05** is kept at a temperature within the acceptable temperature range. However, when the temperature module **120** receives a signal that the infant simulator **05** is being exposed to an unacceptable temperature, the temperature module **120** initiates generation of the thermal exposure signal $\mathbf{S_2}$ by means of the demand signal generating feature **210** embedded within the temperature module **120**, starts timing the length of time the thermal exposure signal $\mathbf{S_2}$ is generated, and turns OFF the bypass signal ↪.

If the thermal exposure signal $\mathbf{S_2}$ is generated for a predetermined time **x** (*e.g.*, 10 minutes), the temperature module **120** increases the intensity of the thermal exposure signal $\mathbf{S_2}$ by means of the escalating demand feature **240** embedded within the temperature module **120**. The thermal exposure signal $\mathbf{S_2}$ is generated at the increased intensity thereafter until the infant simulator **05** is returned to an acceptable temperature.

Once the infant simulator **05** is returned to an acceptable temperature, generation of the thermal exposure signal $\mathbf{S_2}$ is turned OFF, the occurrence of a thermal exposure episode is counted, the duration of time during which the infant simulator **05** was exposed to unacceptable temperatures (*i.e.*, the length of time the thermal exposure signal $\mathbf{S_2}$ was generated) is recorded by the recording feature **220**, the thermal exposure episode timer is stopped and reset, the intensity of the thermal exposure signal $\mathbf{S_2}$ is checked and returned to normal if intensified, the bypass signal ↪ is turned back ON, and the temperature module **120** is exited.

Compression Module 130

As shown in Figure 3, the compression sensing system **50** detects a compression of the doll's head **11**. When compression is detected by the compression sensing system **50**, the compression sensing system **50** signals the compression module **130**.

Referring to Figure 2d, the compression module **130** is bypassed so long as the head **11** of the infant simulator **05** is not being squeezed or compressed. However, when the compression module **130** receives a signal that the head **11** of the infant simulator **05** is being compressed, the compression module **130** initiates generation of the distress signal S_3 by means of the demand signal generating feature **210** embedded within the compression module **130,** starts timing the length of time the distress signal S_3 is generated, and turns OFF the bypass signal $\hookrightarrow$.

If the duration of the compression, as measured by the length of time the distress signal S_3 has been generated, exceeds a predetermined time value **x** (*e.g.*, 10 seconds), the compression module **130** increases the intensity of the distress signal S_3 by means of the escalating demand feature **240** embedded within the compression module **130**. The distress signal S_3 is generated at the increased intensity thereafter until some period of time after compression of the head **11** has ceased.

Once compression of the infant simulator **05** is ceased, the distress signal S_3 continues for some period of time (*e.g.*, 15 minutes) to simulate injury to the infant simulator **05**. Thereafter, generation of the distress signal S_3 is turned OFF, the occurrence of a compression episode is counted by the recording feature **220**, the compression timer is stopped and reset, the intensity of the distress signal S_3 is checked and returned to normal if intensified, the bypass signal $\hookrightarrow$ is turned back ON, and the compression module **130** is exited.

Diaper-Change Module 140

The central microcontroller unit **20** periodically changes the satisfaction signal $\mathbf{St_4}$ requested by the diaper-change module **140**, such as by alternating between a first satisfaction signal $\mathbf{St_4^+}$ transmitted by a first diaper **60a**, and a second satisfaction signal $\mathbf{St_4^-}$ transmitted by a second diaper **60b**.

The time intervals between sequential diaper-change episodes is preferably selected so as to emulate the frequency of diaper changes required by an actual infant. By way of example, when the intervals are a predetermined value, the intervals are preferably between about 20 minutes and 6 hours, and when the intervals are bounded random variables, the intervals are preferably between a minimum of 1 to 2 hours and a maximum of 4 to 6 hours, with a statistical preference for a time interval between approximately 2 and approximately 4 hours.

Referring to Figure 2e, the diaper-change module **140** checks for the currently requested diaper-change satisfaction signal (*e.g.*, $\mathbf{St_4^+}$). The diaper-change module **140** is bypassed so long as the currently requested diaper-change satisfaction signal $\mathbf{St_4}$ is communicated to the diaper-change module **140**.

In the event that either the currently requested diaper-change satisfaction signal $\mathbf{St_4}$ is no longer received by the diaper-change module **140** (*e.g.*, the first diaper **60a** transmitting the diaper-change satisfaction signal $\mathbf{St_4^+}$ has been removed from the infant simulator **05**), or the central microcontroller unit **20** has changed the requested diaper-change satisfaction signal $\mathbf{St_4}$ (*e.g.*, the requested diaper-change satisfaction signal has been changed from $\mathbf{St_4^+}$ to $\mathbf{St_4^-}$), the diaper-change module **140** initiates generation of a soiled-diaper signal $\mathbf{S_4}$ by means of the demand signal generating feature **210** embedded

within the diaper-change module **140**, and starts timing the duration of the diaper-change episode by timing the length of time the soiled-diaper signal S_4 is generated.

In order to end a diaper-change episode before the time limitation **y** has been reached, the diaper-change module **140** must receive both an identification signal S^{ID} (*e.g.*, insertion of an identification key **90** attached to the wrist of the assigned care provider by means of a tamper indicating bracelet **91**) and the currently requested satisfaction signal (*e.g.*, transmission of the diaper-change satisfaction signal St_4^- by diapering the infant simulator **05** with the second diaper **60b**). For the embodiment depicted in Figure 2e, the identification S^{ID} and diaper-change satisfaction signals St_4 may be received in any sequence and do not need to be transmitted simultaneously.

As shown in Figure 2e, the identification requirement is controlled by the identification system feature **250** embedded within the diaper-change module **140**. The identification system feature **250** prevents exiting of the diaper-change module **140** by bypassing the satisfaction option until the identification signal S^{ID} has been received and the identification switch Sw^{ID} has been turned ON.

If the identification signal S^{ID} and the current diaper-change satisfaction signal St_4 are not received within a given time limit **x**, as measured by the length of time the soiled-diaper signal S_4 has been generated, the diaper-change module **140** increases the intensity of the soiled-diaper signal S_4 by means of the escalating demand feature **240** embedded within the diaper-change module **140**. The soiled-diaper signal S_4 is generated at the increased intensity for the remainder of the diaper-change episode (*i.e.*, until the identification signal S^{ID} and the current diaper-change satisfaction signal St_4 are received or the time limitation **y** is reached).

Upon receiving the identification signal S^{ID} and the current diaper-change satisfaction signal St_4, the soiled-diaper signal S_4 is turned OFF, the occurrence of a diaper-change episode is counted and the length of the diaper-change episode recorded by

InsA the recording feature **220**, (A) the intensity of the distress signal $\mathbf{S_3}$ is checked and returned to normal if intensified, a contented signal + is generated (*e.g.*, a soft "cooing" sound), the identification switch $\mathbf{Sw^{ID}}$ is turned back OFF, and the diaper-change module **140** is exited.

In the event that the identification signal $\mathbf{S^{ID}}$ and the current diaper-change satisfaction signal $\mathbf{St_4}$ are never received during a diaper-change episode (*i.e.*, the soiled-diaper signal $\mathbf{S_4}$ is generated until time limitation **y** is reached), the soiled-diaper signal $\mathbf{S_4}$ is turned OFF, the occurrence of a diaper-change episode is counted and the length of the diaper-change episode recorded by the recording feature **220**, the timer for timing the duration of the diaper-change episode is stopped and reset, the intensity of the soiled-diaper signal $\mathbf{S_4}$ is checked and returned to normal if intensified, the identification switch $\mathbf{Sw^{ID}}$ is turned back OFF, and the diaper-change module **140** is exited. The contented signal + is not generated when the diaper-change module **140** is exited in this manner.

The time limitation **y** is employed for purposes of preventing the soiled-diaper signal $\mathbf{S_4}$ from being generated for the remainder of an assignment period in the event that the identification signal $\mathbf{S^{ID}}$ and the current diaper-change satisfaction signal $\mathbf{St_4}$ are never received by the diaper-change module **140**. This allows the program to continue cycling through the other modules and interact with a care provider for the balance of the assignment period when an otherwise willing care provider is unable to provider the diaper-change satisfaction signal $\mathbf{St_4}$, such as could result from a situation in which one of the diapers **60** is misplaced during an assignment period or left at home when traveling.

Rocking Module 150

The central microcontroller unit **20** periodically commences a rocking period and communicates the commencement of a rocking period to the rocking module

150. The central microcontroller unit **20** also controls the duration of each rocking period by transmitting a termination signal to the rocking module **150** after the desired time period has lapsed.

The time intervals between sequential rocking-request episodes is preferably selected so as to emulate the frequency of requests for attention requested by an actual infant. By way of example, when the intervals are a predetermined value, the intervals are preferably between about 1 to 6 hours, and when the intervals are bounded random variables, the intervals are preferably between a minimum of 1 to 2 hours and a maximum of 4 to 6 hours, with a statistical preference for a time interval between approximately 3 and approximately 5 hours.

Similarly, the duration of each rocking period is preferably selected so as to emulate the length of time an actual infant would request attention. By way of example, when the duration of a rocking period is a predetermined value, the duration of each rocking period is preferably between about 10 minutes to 1 hour, and when the duration of a rocking period is a bounded random variable, the duration of each rocking period is preferably between a minimum of about 2 minutes and a maximum of about 60, with a statistical preference for a duration between approximately 5 and 20 minutes.

Referring to Figure 2f, the rocking module **150** is simply bypassed until the central microcontroller unit **20** starts a rocking period. When the central microcontroller unit **20** starts a rocking period, the central microcontroller unit **20** transmits a rocking-request start signal to the rocking module **150**, a rocking-request episode is counted, and the rocking-request episode commenced. The rocking module **150** then initiates generation of the rocking-request signal $\mathbf{S_5}$ by means of the demand signal generating feature **210**, and starts timing the duration of the rocking-request episode by timing the length of time the rocking-request signal $\mathbf{S_5}$ is generated.

In order to end a rocking-request episode before the entire rocking period has elapsed, the rocking module **150** must receive both an identification signal S^{ID} (*e.g.*, insertion of an identification key **90** attached to the wrist of the assigned care provider by a tamper indicating bracelet **91**) and a rocking-request satisfaction signal St_5 (*e.g.*, rocking of the infant simulator **05**). For the embodiment depicted in Figure 2f, the identification S^{ID} and rocking-request satisfaction St_5 signals may be received in any sequence and do not need to be transmitted simultaneously. However, the rocking-request satisfaction signal St_5 must be continuously received throughout the rocking period to prevent initiation of a secondary rocking-request episode in which the rocking-request signal S_5 is turned back ON and the duration of the supplemental rocking-request episode timed.

As shown in Figure 2f, the identification requirement is controlled by the identification system feature **250** embedded within the rocking module **150**. The identification system feature **250** prevents access to the episode termination operations (*i.e.*, turning OFF the rocking-request signal S_5 and terminating timing of the rocking-request episode) by bypassing the satisfaction option until the identification signal S^{ID} has been received and the identification switch Sw^{ID} has been turned ON.

If the identification signal S^{ID} and the rocking-request satisfaction signal St_5 are not received within a given time limit **x**, as measured by the length of time the rocking-request signal S_5 has been generated, the rocking module **150** increases the intensity of the rocking-request signal S_5 by means of the escalating demand feature **240** embedded within the rocking module **150**. The rocking-request signal S_5 is generated at the increased intensity for the remainder of the rocking-request episode (*i.e.*, until the identification signal S^{ID} and the rocking-request satisfaction signal St_5 are received or the end of the rocking period is reached).

Upon receiving the identification S^{ID} and the rocking-request satisfaction St_5 signals, the rocking-request signal S_5 is turned OFF, the length of the rocking-request

episode recorded by the recording feature **220**, the timer for timing the duration of the rocking-request episode stopped and reset, ~~and~~ the intensity of the rocking-request signal S_5 checked and returned to normal if intensified.

In contrast to the diaper-change module **140**, the rocking module **150** requires that the rocking-request satisfaction signal St_5 continue to be transmitted to the rocking module **150** for the entire duration of the rocking period. Failure to continuously provide the rocking-request satisfaction signal St_5 throughout the entire rocking period causes the rocking module **150** to reinitiate generation of the rocking-request signal S_5, ~~and~~ start timing the duration of the secondary rocking-request episode.

In order to end a secondary rocking-request episode before the end of the rocking period, the rocking-request satisfaction signal St_5 must once again be received by the rocking module **150**. It is not necessary to retransmit the identification signal S^{ID} as the identification switch Sw^{ID} remains ON until the rocking period has ended, regardless of the status of the rocking-request satisfaction signal St_5.

When the end of the rocking period is reached, the rocking module **150** performs one of two different sets of operations depending upon the final status of the rocking-request satisfaction signal St_5. In those cases where the rocking-request satisfaction signal St_5 was being received by the rocking module **150** at the end of the rocking period, a contented signal + is generated (*e.g.*, a soft "cooing" sound), the identification switch Sw^{ID} is turned back OFF, and the rocking module **150** is exited. In those cases where the rocking-request satisfaction signal St_5 was not being received by the rocking module **150** at the end of the rocking period, including those cases where the rocking-request satisfaction signal St_5 was never received by the rocking module **150**, the rocking-request signal S_5 is turned OFF, the length of the rocking-request or supplemental rocking-request episode is recorded by the recording feature **220**, the timer for timing the duration of the rocking-request episode is stopped and reset, the intensity of the rocking-request signal S_5 is checked and returned to normal if intensified, the identification switch

Sw^{ID} is turned back OFF, and the rocking module **150** is exited. The contented signal + is not generated when the rocking module **150** is exited in the later manner.

Feeding Module 160

The central microcontroller unit **20** periodically commences a feeding period and communicates the commencement of a feeding period to the feeding module **160**. The central microcontroller unit **20** also controls the duration of each feeding period by transmitting a termination signal to the feeding module **160** after the desired time period has lapsed.

The time intervals between sequential feeding-request episodes is preferably selected so as to emulate the frequency of feedings required by an actual infant. By way of example, when the intervals are a predetermined value, the intervals are preferably between about 1 to 6 hours, and when the intervals are bounded random variables, the intervals are preferably between a minimum of 1 to 2 hours and a maximum of 4 to 6 hours, with a statistical preference for a time interval between approximately 3 and approximately 5 hours.

Similarly, the duration of each feeding period is preferably selected so as to emulate the length of time an actual infant would need to be feed. By way of example, when the duration of a feeding period is a predetermined value, the duration of each rocking period is preferably between about 5 to 20 minutes, and when the duration of a rocking period is a bounded random variable, the duration of each rocking period is preferably between a minimum of about 5 minutes and a maximum of about 30, with a statistical preference for a duration between approximately 10 and 20 minutes.

Referring to Figure 2g, the feeding module **160** is simply bypassed until the central microcontroller unit **20** starts a feeding period. When the central

microcontroller unit **20** starts a feeding period, the central microcontroller unit **20** transmits a feeding-request start signal to the feeding module **160**, a feeding-request episode is counted, and the feeding-request episode commenced. The feeding module **160** then initiates generation of the feeding-request signal $\mathbf{S_6}$ by means of the demand signal generating feature **210**, starts timing the duration of the feeding-request episode by timing the length of time the feeding-request signal $\mathbf{S_6}$ is generated, and turns the burp switch $\mathbf{Sw^{BURP}}$ OFF unless the switch is already OFF.

In order to end a feeding-request episode before the entire feeding period has elapsed, the feeding module **160** must receive both an identification signal $\mathbf{S^{ID}}$ (*e.g.*, insertion of an identification key **90** attached to the wrist of the assigned care provider by a tamper indicating bracelet **91**) and a feeding-request satisfaction signal $\mathbf{St_6}$ (*e.g.*, insertion of a key marked "Feeding"). For the embodiment depicted in Figure 2g, the identification $\mathbf{S^{ID}}$ and feeding-request satisfaction $\mathbf{St_6}$ signals may be received in any sequence and do not need to be transmitted simultaneously. However, the feeding-request satisfaction signal $\mathbf{St_6}$ must be continuously received throughout the feeding period to prevent initiation of a secondary feeding-request episode in which the feeding-request signal $\mathbf{S_6}$ is turned back ON, the duration of the supplemental feeding-request episode timed, and the burp switch $\mathbf{Sw^{BURP}}$ switched back to OFF.

As shown in Figure 2g, the identification requirement is controlled by the identification system feature **250** embedded within the rocking module **150**. The identification system feature **250** prevents access to the episode termination operations (*i.e.*, turning OFF the feeding-request signal $\mathbf{S_6}$ and terminating timing of the feeding-request episode) by bypassing the satisfaction option until the identification signal $\mathbf{S^{ID}}$ has been received and the identification switch $\mathbf{Sw^{ID}}$ has been turned ON.

If the identification signal $\mathbf{S^{ID}}$ and the feeding-request satisfaction signal $\mathbf{St_6}$ are not received within a given time limit **x**, as measured by the length of time the feeding-request signal $\mathbf{S_6}$ has been generated, the feeding module **160** increases the

intensity of the feeding-request signal S_6 by means of the escalating demand feature **240** embedded within the feeding module **160**. The feeding-request signal S_6 is generated at the increased intensity for the remainder of the feeding-request episode (*i.e.*, until the identification signal S^{ID} and the feeding-request satisfaction signal St_6 are received or the end of the feeding period is reached).

Upon receiving the identification S^{ID} and the feeding-request satisfaction St_6 signals, the feeding-request signal S_6 is turned OFF, the length of the feeding-request episode recorded by the recording feature **220**, the timer for timing the duration of the feeding-request episode stopped and reset, the intensity of the feeding-request signal S_6 checked and returned to normal if intensified, and the burp switch Sw^{BURP} turned ON.

As with the rocking module **150**, the feeding module **160** requires that the feeding-request satisfaction signal St_6 continue to be transmitted to the feeding module **160** for the entire duration of the feeding period. Failure to continuously provide the feeding-request satisfaction signal St_6 throughout the entire feeding period causes the feeding module **160** to reinitiate generation of the feeding-request signal S_6, and start timing the duration of the secondary feeding-request episode.

In order to end a secondary feeding-request episode before the end of the feeding period, the feeding-request satisfaction signal St_6 must once again be received by the feeding module **160**. It is not necessary to retransmit the identification signal S^{ID} as the identification switch Sw^{ID} remains ON until the feeding period has ended, regardless of the status of the feeding-request satisfaction signal St_6.

When the end of the feeding period is reached, the feeding module **160** performs one of two different sets of operations depending upon the final status of the feeding-request satisfaction signal St_6. In those cases where the feeding-request satisfaction signal St_6 was being received by the feeding module **160** at the end of the feeding period, a contented signal + is generated (*e.g.*, a soft "cooing" sound), the

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identification switch Sw^{ID} is turned back OFF, and the feeding module **160** is exited. In those cases where the feeding-request satisfaction signal St_6 was not being received by the feeding module **160** at the end of the feeding period, including those cases where the feeding-request satisfaction signal St_6 was never received by the feeding module **160**, the feeding-request signal S_6 is turned OFF, the length of the feeding-request or supplemental feeding-request episode is recorded by the recording feature **220**, the timer for timing the duration of the feeding-request episode is stopped and reset, the intensity of the feeding-request signal S_6 is checked and returned to normal if intensified, the identification switch Sw^{ID} is turned back OFF, and the feeding module **160** is exited. The contented signal + is not generated when the feeding module **160** is exited in the later manner.

Burping Module 170

A burping module **170** is sequentially positioned after the feeding module **160**. During each feeding period, a burp switch Sw^{BURP} is turned ON when the identification signal S^{ID} and feeding-request satisfaction St_6 signals are received. The burp switch Sw^{BURP} remains ON so long as the feeding-request satisfaction signal St_6 is continuously received by the feeding module **160** during the feeding period. In the event that the identification signal S^{ID} and feeding-request satisfaction St_6 signals are never received by the feeding module **160**, or the feeding-request satisfaction signal St_6 is interrupted and is not being received by the feeding module **160** when the feeding period ends, the burp switch Sw^{BURP} is turned OFF.

Burping-request periods can be initiated immediately after the end of a satisfied feeding period or after a defined delay timed from the end of a satisfied feeding period. When a delay is provided between the end of a satisfied feeding period and the initiation of a burping period, the length of the delay is preferably selected so as to emulate the burping needs of an actual infant. By way of example, when the delays are a predetermined value, the delays are preferably between about 0 to 30 minutes, and when

the delays are bounded random variables, the delays are preferably between about 0 to 30 minutes, with a statistical preference for delays of between approximately 2 and 10 minutes.

Similarly, the duration of each burping period is preferably selected so as to emulate the length of time an actual infant would need to be burped. By way of example, when the duration of a burping period is a predetermined value, the duration of each burping period is preferably between about 2 to 60 minutes, and when the duration of a burping period is a bounded random variable, the duration of each burping period is preferably between about 2 to 60 minutes with a statistical preference for a duration of between approximately 5 and 20 minutes.

Referring to Figure 2h, the burping module **170** is bypassed when the burping switch $\mathbf{Sw}^{BURP}$ is OFF (*i.e.*, the infant simulator **05** does not want to be burped when the infant simulator **05** was not properly feed). However, when the burping switch $\mathbf{Sw}^{BURP}$ is ON, a burping-request episode is commenced and counted, and the burping switch $\mathbf{Sw}^{BURP}$ switched OFF. The burping module **170** then initiates generation of the burping-request signal $\mathbf{S}_7$ by means of the demand signal generating feature **210** embedded within the burping module **170** and starts timing the duration of the burping-request episode by timing the length of time the burping-request signal $\mathbf{S}_7$ is generated.

As with the rocking period and the feeding period, the central microcontroller unit **20** controls the duration of each burping period by transmitting a termination signal to the burping module **170** after the desired time period has lapsed.

In order to end a burping-request episode before the entire burping period has elapsed, the burping module **170** must receive both an identification signal $\mathbf{S}^{ID}$ (*e.g.*, insertion of an identification key **90** attached to the wrist of the assigned care provider by a tamper indicating bracelet **91**) and a burping-request satisfaction signal $\mathbf{St}_7$ (*e.g.*, patting of the infant simulator **05**). For the embodiment depicted in Figure 2h, the identification

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$\mathbf{S^{ID}}$ and burping-request satisfaction $\mathbf{St_7}$ signals may be received in any sequence and do not need to be transmitted simultaneously. However, the burping-request satisfaction signal $\mathbf{St_7}$ must be continuously received throughout the burping period to prevent initiation of a secondary burping-request episode in which the burping-request signal $\mathbf{S_7}$ is turned back ON and the duration of the supplemental burping-request episode timed.

As shown in Figure 2h, the identification requirement is controlled by the identification system feature **250** embedded within the burping module **170**. The identification system feature **250** prevents access to the episode termination operations (*i.e.*, turning OFF the burping-request signal $\mathbf{S_7}$ and terminating timing of the burping-request episode) by bypassing the satisfaction option until the identification signal $\mathbf{S^{ID}}$ has been received and the identification switch $\mathbf{Sw^{ID}}$ has been turned ON.

If the identification signal $\mathbf{S^{ID}}$ and the burping-request satisfaction signal $\mathbf{St_7}$ are not received within a given time limit **x**, as measured by the length of time the burping-request signal $\mathbf{S_7}$ has been generated, the burping module **170** increases the intensity of the burping-request signal $\mathbf{S_7}$ by means of the escalating demand feature **240** embedded within the burping module **170**. The burping-request signal $\mathbf{S_7}$ is generated at the increased intensity for the remainder of the burping-request episode (*i.e.*, until the identification signal $\mathbf{S^{ID}}$ and the burping-request satisfaction signal $\mathbf{St_7}$ are received or the end of the burping period is reached).

Upon receiving the identification $\mathbf{S^{ID}}$ and the burping-request satisfaction $\mathbf{St_7}$ signals, the burping-request signal $\mathbf{S_7}$ is turned OFF, the length of the burping-request episode recorded by the recording feature **220**, the timer for timing the duration of the burping-request episode stopped and reset, and the intensity of the burping-request signal $\mathbf{S_7}$ checked and returned to normal if intensified.

As with the rocking module **150** and the feeding module **160** the burping module **170** requires that the burping-request satisfaction signal $\mathbf{St_7}$ continue to be

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transmitted to the burping module **170** for the entire duration of the burping period. Failure to continuously provide the burping-request satisfaction signal $\mathbf{St}_7$ throughout the entire burping period causes the burping module **170** to reinitiate generation of the burping-request signal $\mathbf{S}_7$, and start timing the duration of the secondary burping-request episode.

In order to end a secondary burping-request episode before the end of the burping period, the burping-request satisfaction signal $\mathbf{St}_7$ must once again be received by the burping module **170**. It is not necessary to retransmit the identification signal $\mathbf{S}^{\mathbf{ID}}$ as the identification switch $\mathbf{Sw}^{\mathbf{ID}}$ remains ON until the burping period has ended, regardless of the status of the burping-request satisfaction signal $\mathbf{St}_7$.

When the end of the burping period is reached, the burping module **170** performs one of two different sets of operations depending upon the final status of the burping-request satisfaction signal $\mathbf{St}_7$. In those cases where the burping-request satisfaction signal $\mathbf{St}_7$ was being received by the burping module **170** at the end of the burping period, a contented signal + is generated (*e.g.*, a soft "cooing" sound), the identification switch $\mathbf{Sw}^{\mathbf{ID}}$ is turned back OFF, and the burping module **170** is exited. In those cases where the burping-request satisfaction signal $\mathbf{St}_7$ was not being received by the burping module **170** at the end of the burping period, including those cases where the burping-request satisfaction signal $\mathbf{St}_7$ was never received by the burping module **170**, the burping-request signal $\mathbf{S}_7$ is turned OFF, the length of the burping-request or supplemental burping-request episode is recorded by the recording feature **220**, the timer for timing the duration of the burping-request episode is stopped and reset, the intensity of the burping-request signal $\mathbf{S}_7$ is checked and returned to normal if intensified, the identification switch $\mathbf{Sw}^{\mathbf{ID}}$ is turned back OFF, and the burping module **170** is exited. The contented signal + is not generated when the burping module **170** is exited in the later manner.

Fussy Module 180

The central microcontroller unit **20** periodically commences a fussy period and communicates the commencement of a fussy period to the fussy module **180**. The program also controls the duration of each fussy period by transmitting a termination signal to the fussy module **180** after the desired time period has lapsed.

The duration of each fussy period is preferably selected so as to emulate the length of time an actual infant would tend to fuss. By way of example, when the duration of a fussy period is a predetermined value, the duration of fussy period is preferably between about 5 to 20 minutes, and when the duration of a fussy period is a bounded random variable, the duration of each fussy period is preferably between about 2 to 60 minutes with a statistical preference for a duration of about 5 to 20 minutes.

Referring to Figure 2i, the fussy module **180** is simply bypassed until the central microcontroller unit **20** commences a fussy period. When the central microcontroller unit **20** commences a fussy period, the central microcontroller unit **20** transmits a fussy start signal to the fussy module **180**, and a fussy episode is commenced. The fussy module **180** then initiates generation of the fussy signal $\mathbf{S_8}$ by means of the demand signal generating feature **210** embedded within the fussy module **180**.

In contrast to the other episodic modules (*i.e.*, the diaper-change module **140**, the rocking module **150**, the feeding module **160** and the burping module **170**) a fussy episode cannot be ended until the entire fussy period has run. Hence, the fussy signal $\mathbf{S_8}$ will be generated throughout a fussy period regardless of the actions taken by the care provider. The fussy module **180** emulates those times when, despite every effort by a care provider, an infant cannot be satisfied and continues to fuss. Since the fussy episode cannot be satisfied, the fussy module **180** does not include the recording **220**, contented signal **230**, escalating demand **240** or identification **250** features embedded within the other modules.

When the end of the fussy period is reached, the fussy signal $\mathbf{S_8}$ is turned OFF and the fussy module **180** is exited. A contented signal + is not generated.

Assignment Period Module 190

The infant simulator 05 initiates timing of the assignment period upon activation. The duration of the assignment period can either be continuous (*i.e.*, continuing until a teacher or other program administrator takes custody of the infant simulator 05 and stops the assignment period), or predetermined (*i.e.*, a preset duration of 6, 8, 24, 36, 48 or 72 hours selected by the teacher or other program administrator at the beginning of the assignment period.

When the assignment period is a predetermined time period, the central microcontroller unit **20** is preprogrammed with a defined assignment period. The assignment period module **190** compares the length of time the infant simulator **05** has been activated against the duration of the defined assignment period, and causes the program to continue cycling through the various modules until the length of time the infant simulator **05** has been activated equals or exceeds the duration of the defined assignment period. Once the activation period equals or exceeds the assignment period, the program is ended.